

16-30 NOVEMBER, 2020

DownToEarth

FORTNIGHTLY ON POLITICS OF DEVELOPMENT, ENVIRONMENT AND HEALTH

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ONLINE TRAINING ON

EIA: A REQUIREMENT BEYOND CLEARANCE

COURSE DATE: December 7–16, 2020

LAST DATE TO APPLY: December 3, 2020

COURSE FEES: INR 2000

In 1994, an Environmental Impact Assessment (EIA) Notification was brought in with an objective to minimize the adverse impacts of developmental projects. But it has become a mere clearance process. This is, in part, a result of weakening of the Notification through amendments. But another factor is also responsible for the enfeeblement of EIA.

There are three important stakeholders in an EIA study: project proponent, consultant and regulators. Each of them has a role to play in identifying and quantifying the impacts of a project and implementing appropriate mitigation measures. A good EIA study can actually prove beneficial to the project proponent and save them the cost incurred due to non-compliance. However, there is a lot of ignorance on the mechanism of EIA and this also leads to its non-optimal implementation.

In order to make the process of EIA substantial, clearer and deeper understanding is the need of the hour. To this end, Centre for Science and Environment, is organizing a 10 day-long online training course on the topic.

COURSE OBJECTIVE:

The online course has been designed to capacitate environmentalists and prospective environmentalists to develop a better understanding of the EIA process.

The course will be conducted through presentations, recorded videos, discussion with experts and reading material.

Course Coordinator

Ishita Garg

Programme Officer, Industrial Air Pollution

Email: ishita.garg@cseindia.org



KEY TAKEAWAYS

- Consequences of poor EIA reporting
- Methodology for EIA preparation
- Methodology for data collection
- Evaluation, interpretation and validation of data
- Analysis of socio-economic impacts
- Preparation of Environmental Management Plans
- Case studies on good environmental practices
- Review and evaluation of EIA reports
- EIA legislation: India and developed countries

WHO CAN APPLY?

- Industry professionals, environment consultants and environment engineers
- Researchers and academics
- Students aspiring to work in the field of environment

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PROGRAMME**

Biden's transformational challenge

IT'S TIME to exhale. Donald Trump is now the former US president. President-elect Joe Biden and his vice president-elect, Kamala Harris, have stated they will rejoin the Paris Agreement on climate change. So denial of this existential threat to the Planet is now past. And we can move decisively on actions. Or, so we hope. This is where we need a dose of realism. I am not undermining the Biden-Harris triumph, but reminding us of the troubled paths ahead. The world is hurtling down to a climate change-led catastrophe. We cannot afford coy and small answers.

This is where introspection of the Biden-Harris victory must start. The fact is they won, but Trumpism did not lose. What is shocking to most of us, watching from the outside, is that close to half of America voted for him. He got more votes in 2020 than in 2016, notwithstanding his failure in managing the uncontrolled pandemic, his rejection of climate change and his exacerbation of race and gender conflicts. We need to remember this.

The US is a divided nation and the deep rift has its foundations on what nearly half of the American people want. You can say Biden-Harris won because they said they would control the virus; they would listen to scientific advice on the need to wear masks; and, impose lockdowns when necessary. But it is also a fact that people voted for Trump because they did not want any of these. They believe the economy is more important than the virus. You can argue that the virus does not discriminate, but it hits poor people more. But they are not listening.

Let's also be clear that more than ever before, this US election had climate change denial or action on the ballot. It was an issue that was on the table—Trump made sure of that. He was belligerent about his opposition to this “fake” science. He swore by coal and, more importantly, he pushed his country to manufacture more: made in USA was his slogan. Pushing against climate change—in spite of the terrible fires and hurricane damages—was his way of putting the economy above everything else. His people saw this.

We need to take off our rose-tinted glasses that all is well. The US has always been a renegade nation as far as climate action is concerned—the abysmally insignificant targets it has set for itself under the Paris Agreement are a testimony to this. It is of course another matter that Biden-Harris will, at least, do something and not work against action. But this is only because Trumpism took us down to depths that we never imagined before.

It is also a fact that Trump is right (and completely wrong) on one thing. He says his country's energy emissions were lowest during his term; this is right. The US energy sector's emissions declined by a massive 30 per cent in the past decade. The shift was primarily because market factors moved the power sector away from coal to shale and natural gas. In the last year alone, coal-fired power generation fell by 18 per cent, according to data from the private research firm, Rhodium Group. This is where the good news ends.

The fact is that cheap shale gas took off where coal left—and it left behind the renewable energy surge as the cost of gas has fallen to a record low. It is no wonder then that Biden has strayed off the New Green Deal agenda of his deputy to argue that he will not stop fracking of gas on private lands, where the bulk of the gas is found.

But the bigger problem is that other sectors of the US economy are now reversing any gains made from the transition from polluting coal. The transportation sector has overtaken energy emissions and industrial sector emissions have grown. The bottom-line is that even though US emissions fell by some 2 per cent in 2019 and there was a cumulative decline of 12.3 per cent on its 2005 baseline, the country is still way off the mark to meet its targets. As per the Copenhagen Accord target it signed, the US agreed to be 17 per cent below 2005 levels by the end of 2020, and as per the Paris Agreement, 26-28 per cent below 2005 levels by 2025. In fact, net US greenhouse emissions in 2019 were higher than at the end of 2016—the beginning of the Trump presidency.

What should concern us is that further decline will be hard. This is not only because of the increase in Trump's vote share; it is because there are no easy answers for rapid and transformational emission cuts in the country. Though the US is no longer addicted to coal; it is completely sold on the idea of cheap energy. It also wants to reclaim its role as the economic powerhouse—take back its position from China. This will mean burning more fuel for industrial growth and using more energy that will negate all the gains of cleaner fuels. This, when we need transformational answers. So, let's not kid ourselves that all will be well now that Biden-Harris are in power. We need to push more and force them to run, and not walk, the talk.. [DTE](#) [@sunitanar](#)

Though the US is no longer addicted to coal; it is completely sold on the idea of cheap energy

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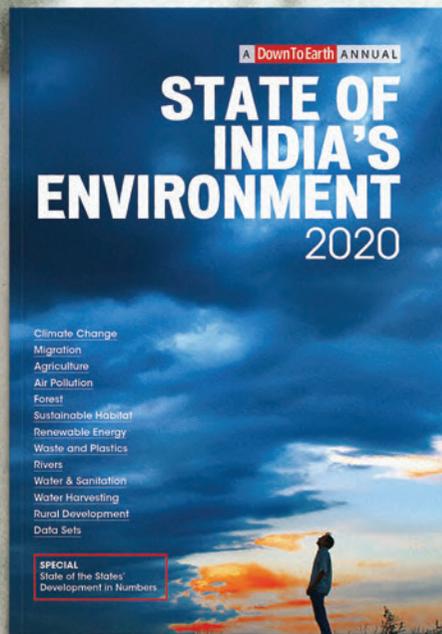
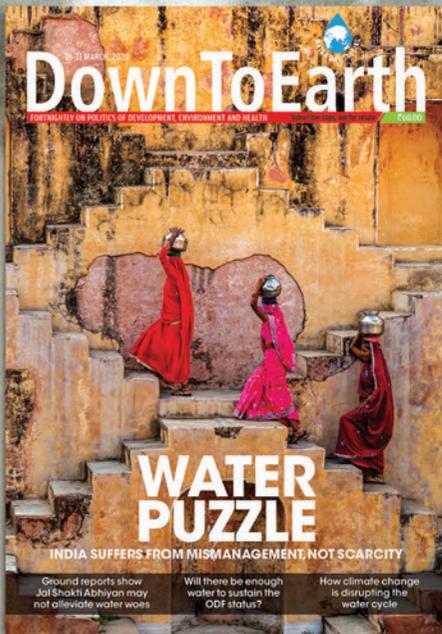
Nagaland's tree tomato is an excellent substitute for the regular one

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Engage



Thank you for giving voice to innovation

This is to inform that your coverage on banana fusarium wilt (“On slippery peel”, *Down To Earth*, 16-30 September, 2020) and its control using FUSI-CONT technology that we have developed at the Central Soil Salinity Research Institute (CSSRI), Lucknow, has attracted a good demand for the technology among the national and international agencies. These are the agencies that have been searching for a viable technology for the management of the disease. We are now processing collaborations with international agencies through the Indian Council of Agricultural Research for serving the poor farmers of the Philippines and Malaysia with our technology. The dream of our prime minister in making the country a leader in the technological front for serving the humanity is not a far reach if journalists like you come to the forefront and serve as ambassadors for the country’s scientific fraternity.

T DAMODARAN, PRINCIPAL SCIENTIST
ICAR-CENTRAL SOIL SALINITY RESEARCH INSTITUTE, LUCKNOW

Need to relook at governance

This is in reference to the editorial “Hold your breath, it’s still unsafe” (1-15 November, 2020). It’s strange that on the one hand we are able to launch Mangalyaan and Chandrayaans and on the other hand we fail to manage our garbage, including the agri-diary-poultry-industrial wastes. I think we really need to re-look at our administration and governance and explore all technological possibilities to breathe clean air and realise the dream of “New India”.

NAND KISHORE AGARWAL
VIA EMAIL

We don’t get it, WII

This is in reference to the article “Can’t do without support: Wildlife Institute chief writes to environment ministry” published online on October 20, 2020. India’s population is nearing 1.4 billion. Then why does the Wildlife Institute of India have a provision for selecting and taking in just 20 students? Why does it restrict itself to only a few subjects? What is the meaning of autonomy? Why does it charge such a minimum fee?

VIBHU RAKESH
VIA EMAIL

There are ways to end the sorrow of onion

This is in reference to your interesting cover story “I am the onion” (1-15 October, 2020). I have a few comments to add to what you have already said in the article. Onion has definitely become sensitive vegetable and its availability and non-availability in Delhi alone is national issue. A major reason for this is we still follow very traditional storage



and preservation technologies for the crop. We need to introduce modern methods for this. The Government of India does import onions. But in past, due to inadequate specifications related to size and weight, the stocks of onion that landed at ports were weighing 200 to 350 grams per bulb. Those were certainly not suited for Indian kitchen. But here we have a clue—an experimental cultivation can be done to produce such large onions for hotels and *dhabaas* that dot north India. This will not only boost the area under onion but also farm productivity of the crop, and thereby, ease the demand on regular onions, prized by Indian kitchens. Besides, timing of imports is either early or late. This either hits the farmers or the consumers. I feel there is an urgent need to accelerate validation of irradiation technology for extending the shelf life of both onions and potatoes. In a nutshell, high farm productivity of existing onion varieties and the large bulbs, improving their distribution system and modernisation of preservation technology are paramount to end the sorrow of onions, farmers as well as consumers.

B JAGDISH RAO
BUSINESS HEAD, MOTHER DAIRY SAFAL, DELHI

Follow the laws of nature

The article "How much is zero?" (1-15 September 2020) reminded me of permaculture. The term was coined by Bill Mollison of Tasmania, Australia, in the early 1970s who was awarded the Right Livelihood Award (otherwise known as the Alternative Nobel Prize) for his contribution in the search for alternatives. Indeed, any agriculture is unnatural as the concept of agriculture does not exist in nature. Even if it is 900 per cent organic, it is still unnatural. So, in order to make agriculture sustainable, we should make an attempt to follow the laws of nature. Otherwise, it will result in mining, depleting, polluting and poisoning the natural resources. Permaculture is a practice where relationship between humans and natural resources are ensured and natural resources are utilised wisely, ethically and judiciously.

JAYDEV JANA
VIA EMAIL

ILLUSTRATION: RITIKA BOHRA / CSE



Will the vaccine offer ultimate protection?

There is a difference in the ability of vaccines to offer protection, says Peter Hotez, founding editor-in-chief of *PLoS Neglected*



Tropical Diseases and professor at Baylor College of Medicine, Texas, USA. If that is the case and the virus is still circulating among the populations, India will have to continue with public health measures as aggressively as it is being done at the moment, he says, adding that the tough part is going to be the ability to disseminate vaccines quickly among the people.

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Digest

WHAT'S INSIDE

A lawyer who logged on to social media to help stranded migrants during lockdown **P10**

Sri Lanka forces the UK to take back illegal waste containers **P11**

La Niña returns to disrupt weather patterns worldwide **P12**

1,000 WORDS VIKAS CHOUDHARY



As the air gets colder and denser and a thick haze envelops Delhi and the national capital region, regulatory authorities of Ghaziabad, one of the most polluted cities in the country, have initiated a crackdown on illegal factories along the Hindon river that usually run furnaces and engage in extraction of chemicals in the open. The state pollution control board identifies the area along the Hindon as one of the air pollution hot spots.

FOR MORE PHOTOS, SCAN



Fighting for the right

I VIVIDLY remember the scene at the railway station on the morning after the nationwide lockdown was announced to curb the spread of COVID-19 on March 24," says lawyer-activist Priyanka Shukla from Bilaspur, Chhattisgarh. The lockdown, which took effect at midnight, was announced with just four hours' notice. During that short period, more than 300 people had managed to reach the station and were waiting for connecting trains to go to their villages or home towns. But they were stranded after the railways too cancelled all passenger trains.

What came as a rude shock is that the railway authorities had even shut down the public utilities and were chasing the people away, recalls Shukla. The widespread apathy prompted her to take to the social media to garner support. One of her tweets, that highlighted that 126 of the stranded labourers were from Jharkhand, prompted the state's chief minister Hemant Soren to reply. Immediately, the local administration provided vehicles for their safe return. Soon, similar arrangements were made for labourers who hailed from Bihar. Meanwhile, following the public pressure,

Priyanka Shukla and her friends fought the administration to provide assistance to informal workers in Chhattisgarh during the lockdown

AVDHESH MALLICK



the labourers who hailed from West Bengal and Assam were temporarily shifted to schools. Towards the end of April, the government announced that it will charge ₹ 3,000 from each labourer for ensuring their safe return home." By now, I was volunteering with 14 of my friends and we all mounted pressure on the government through social media," she recalls, adding that she received calls from officials who accused her of defaming the government.

But as their social media presence increased, they also started getting requests from people who wanted to help. So, Shukla and her group decided to set up a small kitchen on the outskirts of Bilaspur to provide meals to the desperate travellers. By May, about 200 workers were crossing Bilaspur every night on foot or on cycle. They mostly hailed from Jharkhand, Uttar Pradesh, Madhya Pradesh and were travelling from the southern states and Maharashtra. Shukla and her group hired buses to ferry the returning

informal workers back home. "We did not want to handle money so we asked the people who were donating to directly transfer to the vendors we were buying from," she says. "We are glad that many came forward to support us and help the returning workers."

Sri Lanka returns illegal waste containers to UK

RAJAT GHAI

AFTER a two-year court battle, Sri Lanka has started shipping back the 263 waste containers that were illegally brought into the country from the UK.

The containers were brought into the island nation through 2017 and 2018 under the National Environmental Act 1980. This was done to circumvent the Basel Convention, which calls for clearances from the governments of both the exporting and importing countries.

Wealthy western nations ship their waste to developing countries since it is cheaper, helps

to meet their recycling targets and also reduces domestic landfill needs.

The containers, which were accidentally discovered later, contained clinical waste, used cushions and mattresses, plant parts, plastic waste and other hazardous and uncategorised wastes.

The importer was Sri Lanka based Ceylon Metal Processing Pvt Ltd, and the exporter was a UK company owned by the brother of the owner of Ceylon Metal.

In July 2019, a Sri Lankan non-profit filed petition in the country's Court of Appeal for the immediate return of the containers. The court ini-



tially directed the Central Environmental Authority (CEA), the government agency responsible for pollution control, and the customs, to open all the containers and check the contents. The authorities surprisingly refused citing they did not have the resources and later the exporter agreed to take the imported waste back.

As a pilot activity,

the government agencies repatriated 21 containers on September 26, 2020. They arrived in the UK on October 28, 2020. The customs department also sent another 20 containers on October 30, 2020. Another 65 were sent on November 4, 2020. The Sri Lankan Ministry of Environment has demanded over US\$ 9 million in damages.

'AGENCIES ARE YET TO TAKE ACTION AGAINST ERRING PARTIES'

Hemantha Withanage of Centre for Environmental Justice petitioned in the Sri Lankan court for the removal of the containers. He believes Asian countries need to improve vigil to avoid such incidents in the future. **What prompted you to go to court?**

When we saw the news we realised that the customs department was reluctant to take legal actions easily since the companies involved were powerful. We also learnt that certain agencies were trying to justify the waste import



under their hub operation process. **Are you happy with the way Sri Lanka handled the crisis?** We are happy with the court order and the related steps to send the containers back. The Central Environmental Authority and the customs

department are still working on the Court of Appeal's order to take appropriate legal action against the parties responsible. **What steps can be taken by Sri Lanka in particular and other south Asian countries like India to avoid such incidents in the future?** Harbours are the main entry point for waste containers. Therefore regulatory authorities have to be extremely vigilant. Countries need strong regulations to implement the Basel Convention. This should include higher

finances, along with single-window information system. Currently, details about a container are available after it has entered the country. Once docked, these erring companies pressurise governments and try to find a way out. In the recent case, for example, Sri Lankan authorities refused to open the containers and make a report. The excuse they gave to the court is that they do not have the necessary space or equipment. If that be the case, then the government should set up the necessary facilities.

Torchbearer of anti-uranium movement

TARUN BHARTIYA

MANY YEARS ago, I was in Domiasiat village in Meghalaya's West Khasi Hills. Domiasiat sits on top of India's biggest uranium deposits. After eight hours and a 50 odd-km journey, I got off at Wahkaji in the evening and walked for an hour to reach a village of seven households. I wanted to meet Kong Spelity Lyngdoh Langrin, the matriarch of Domiasiat. She had refused to lease her land to the

Uranium Corporation of India Ltd (UCIL) even after being offered ₹1.5 crore annually for 30 years. "Money will not buy my freedom," she had said.

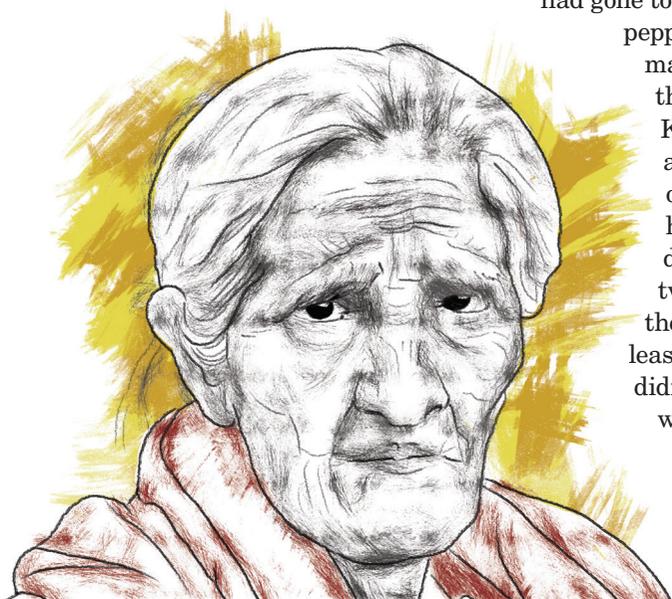
She was instrumental in chasing out *dkhars* (non-Khasi people) who came to her village with the Atomic Minerals Division to prospect and test mines for uranium. When we reached Domiasiat, she wasn't there. She had gone to the forest to gather

pepper and bay leaf for the market. She came back the next day. I asked Kong Spelity about the amount of land she owned. She described herself as not well-to-do, although she owned two hills. I asked her then as why she did not lease her land to UCIL. She didn't reply but started walking briskly towards a clump of trees. The clump hid a small waterfall and pool. She stopped and turned to me and said something about freedom; about how selling

the land would be like selling her freedom and how money could not buy the river, the land and the waterfall. It took some time for me to get it all. A few months later, I managed to go on an exposure trip to Jaduguda uranium mines in Jharkhand which UCIL was organising with some local Khasi notables—politician, contractors and youth leaders. The purpose was to counter the so-called false narrative that the anti-uranium movement was supposedly spreading with screenings of *Buddha Weeps* in Jadugoda, dubbed in Khasi. I asked a senior technocrat of UCIL about uranium mining displacing people. He said, "We will rehabilitate them. We will pay them, even make houses for them, give some of them salaried employment. They may have land but they don't know the value of that land."

That conversation made me realise that why people who have lived with land being privatised, expropriated, labour being turned into commodity and hierarchy being sacralised, find it difficult to understand Kong Spelity. **DTE**

(Bhartiya, a Shillong-based film maker and activist, photographed Kong Spelity for many years)



KONG SPELITY LYNGDOH LANGRIN
(1925-2020)

La Niña to upset weather pattern, fuel food crisis

LA NIÑA is back after almost a decade. As this weather event develops in the central and eastern equatorial Pacific Ocean and continues through March, it is expected to usher in drier and wetter conditions than normal in different parts of the world, according to the latest World Meteorological Organization (WMO) report.

La Niña conditions usually result in sea surface temperatures between 2°C and 3°C cooler than average, says Maxx Dille, deputy director in charge of Climate Services Department at WMO. "These coolings of these large ocean areas have a significant effect on the circulation of the atmosphere that's flowing over them. And the

changes in the atmosphere in turn affect precipitation patterns around the world." Indications are that Southeast Asia, some Pacific Islands and the northern region of South America will revive above-average rainfall. In India, La Niña may lead to floods. On the other hand, Horn of Africa and Central Asia will see below average rainfall. This drier than usual conditions in Horn of Africa is a particular cause of concern, as along with the ongoing desert locust invasion, it may add to regional food insecurity. The WMO report said this year's La Niña "is expected to be moderate to strong". The last time such a strong event was recorded in 2010-2011, followed by a moderate event the next year.



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Kerala's caseload of 12,329 per million populations is more than the double of the national average



REPEAT ATTACK

Kerala's struggle with the second wave of COVID-19 should serve as a warning to other states

K A SHAJI

THIRUVANANTHAPURAM, KERALA

THE STRIKE was highly unexpected. After all, Kerala had easily gained an upper hand over the novel coronavirus (COVID-19) despite reporting the first positive case as early as on January 30. By April when the pandemic began tightening its grip on other parts of the country, it had flattened the curve. From higher literacy rates and a thriving grassroots democracy to robust healthcare infrastructure, experience in controlling the 2018 Nipah virus outbreak and an agile response to COVID-19, all played a key role as Kerala emerged as a "model" in containing the pandemic.

But everything seems to be falling apart since September. The state started recording a spike in daily cases early

“We need to be alert till November”

K K SHAILAJA, Minister of Health and Social Justice in Kerala, on the state’s response to the second wave of coronavirus cases.

Excerpts:

What has triggered the second wave and how are you planning to handle it?

There are demographic and epidemiological reasons behind this new surge. Kerala government has been able to keep casualties low due to sustained interventions. Though there was a spike in the last week of October, there has been a downward trend November onwards. There are days in which recoveries outsmart new cases.

Our focus is on minimising the mortality rate by improving our medical capacity. The state is preparing to handle up to 15,000 new cases every day. The ventilator occupancy in the state is presently at 20 per cent, intensive care unit occupancy at 42 per cent and bed occupancy at 50 per cent. We are committed to increasing such facilities. Kerala’s daily test positivity rate is more than three times the national average. We have to keep in mind that as well.

Is the celebrated Kerala model suffering setbacks?

We never created any false projections of our achievements. International health experts and media have praised Kerala



for the early intervention and coordination of doctors and health workers to contain the pandemic threat effectively and scientifically. Even now, we are explaining to people both our gains and inabilities.

How is demography responsible for the surge?

The demographic situation in Kerala is almost similar to that of the big metros. The population density in Kerala is 856 people per sq km. The national average is below 500. We are also a state with a high number of lifestyle diseases, and hence, we are facing an epidemiological challenge as well. Currently our focus is on people with lifestyle diseases and those who lack immunity. The elderly also require special

care and focus.

Is Onam responsible for the spike, as alleged by the Union Health Minister?

When the statement of the Union minister created national headlines, I contacted him for clarity. He explained that the comment was made as a warning to other states which went into similar modes of festivities. Both the centre and the state are coordinating in the fight against the pandemic and we have a common cause. Onam is Kerala’s biggest festival and we ensured limited relaxations on that occasion. But people violated the protocol at places contributing to the recent spike. The state has also witnessed several political protests in the recent days and they too might have contributed to the spike. The return of people from other states and abroad have added to the crisis.

When will the second wave flatten?

We are hopeful of better results as the case pool is going down. People need to remain careful at least till the end of the month. Prohibitory orders are in place. The government is doing all it can.

KERALA HAS A HIGH POSITIVITY RATE, WHICH SUGGESTS TESTING IS LIMITED AND OFFICIALS ARE MOST LIKELY TO MISS NEW CHAINS OF TRANSMISSION IN THE COMMUNITY

October and it peaked by the third week of the month. Though daily case count started a downward trend in November, the state was only behind Maharashtra—the state with highest number of infections. Its caseload was 12,329 per million population in the first week of November, which is more than the double of the national average.

“The state is currently focusing on containing the death rate,” says K K Shailaja, Minister of Health and Social Justice in Kerala (see “We need to be alert till November” p15). The death rate was 0.35 per cent on November 3, which was substantially lower than 7.7 per cent in May (see “Is second wave less fatal?”, p17).

But the sharp rise in cases has overwhelmed the state’s health infrastructure. Almost all government hospitals have turned into COVID-19 hospitals. Still, beds are falling short. According to the Indian Medical Association (IMA), Kerala, 80 per cent ICU-ventilator beds in the state are already occupied. Over 70 health workers are getting tested positive every day, causing a severe scarcity in the number of key medical professionals. In the first week of November, only one doctor, two nurses and two attendants were tending to 50 patients. “This ratio has to be improved,” says Abraham Varghese, president of IMA-Kerala. The paucity of medical staff and beds means that non-COVID patients are being denied treatment, he adds. As per an official estimate, the state has over 5,000 beds in government hospitals, 35,000 beds in the first-line treatment centers and another 1,000 ICU beds. The state faces a “health emergency”, claims health expert S S Lal, adding that this can be arrested only by quickly increasing the tertiary care with much more ventilator facilities.

The other worrying trend is the state’s positivity rate—percentage of people tested positive of the total testing. According to the World Health Organization, a country should relax lockdown measures only if the positivity rate is below 5 per cent for over two weeks. In Kerala, it is fluctuating between 11 and 13 per cent. This suggests testing is limited to people with high suspicion of COVID-19 and that officials are most likely to miss new chains of transmission in the community. “The state is testing hardly 50,000 people a day. Our demand is to increase the daily testing numbers to at least 100,000,” says Varghese. Limited resources also mean that not every person who tests positive is isolated properly. This is facilitating the transmission. The Kerala government also changed its initial policy of hospitalising all COVID-19 patients. Hospitals now admit only those who are seriously ill or have comorbidities.

Apart from these, there are three other reasons responsible for the second wave. The irresponsible way in which Keralites celebrated the harvest festival of Onam; recent political protests in the state triggered by the gold scam which has implicated the chief minister’s principal secretary; and the surge in returning people from other states and abroad. In other words, the people in the state have started taking the pandemic lightly and the authorities have let matters be.

This should be now a lesson for other states. India is already celebrating the festive season. Add to this the onset of the winters, when respiratory tract diseases flare up. This can be seen at play in Delhi, the other state witnessing a surge in COVID-19 cases. The capital state has a positivity rate of about 10 per cent along with a case fatality rate of 1.7 per cent. A desperate Delhi Chief Minister Arvid Kejriwal has announced a ban on crackers this Diwali and even moved court to pressure private hospitals to increase their ICU beds for COVID-19 patients. There are also chances of a spike in Bihar, on the back of the recently concluded Assembly elections.

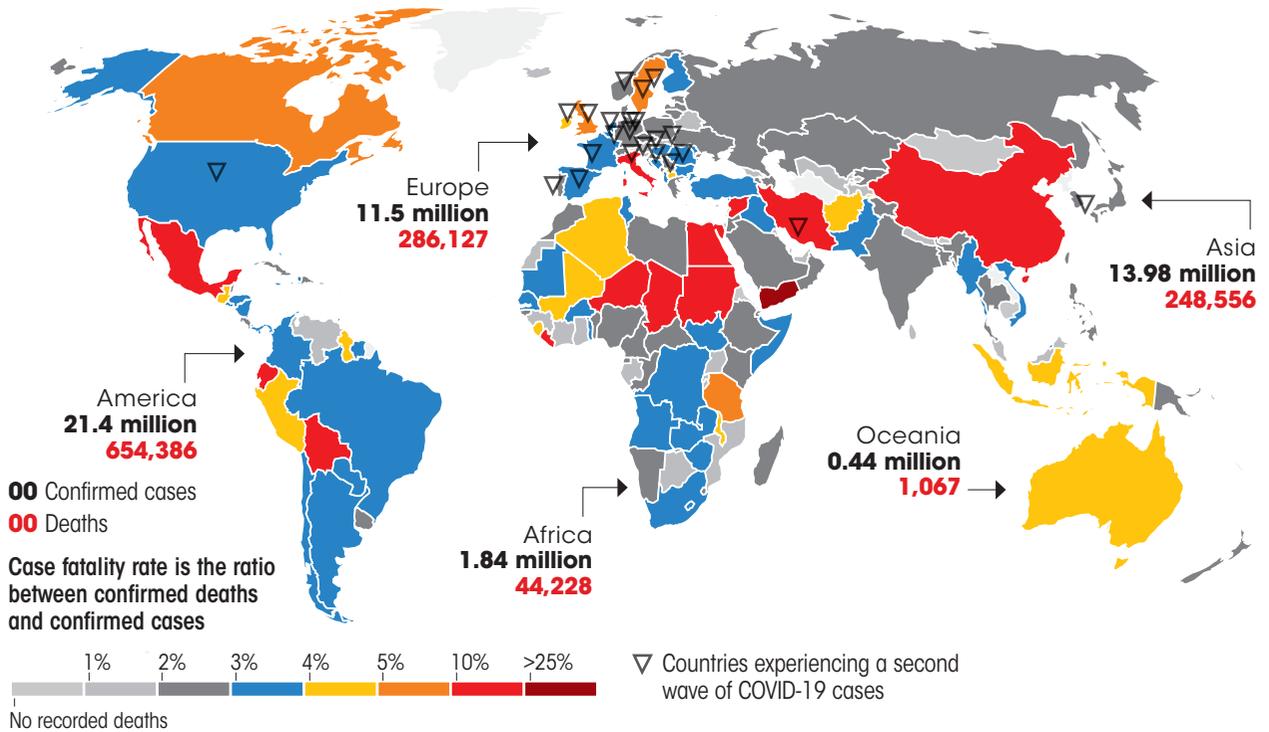
Kerala has clearly lost its hard-fought initial gains. The rest of India should try not to repeat the mistake. **DTE**

 @down2earthindia



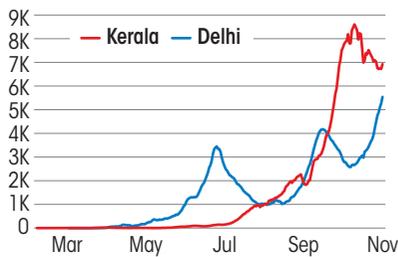
IS SECOND WAVE LESS FATAL?

The 20-odd countries that are drowning in a second wave have a **case fatality rate** lower than 2 per cent. The **global average** is 2.5 per cent



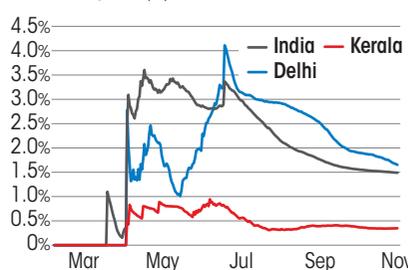
Two Indian states are recording a resurgence in cases

Daily cases (7-day moving average)



Kerala's fatality rate is low; Delhi sees more than India average

Case fatality rate (%)



28%

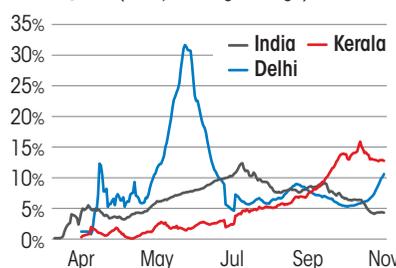
The share of Kerala and Delhi in the **daily cases** recorded in India on November 5

14%

The share of the two states in the **daily deaths** recorded in India on November 5

Neither states are testing enough to check new transmission

Positivity rate (7-day moving average)



Reasons for low fatality

Young are getting infected

The median age of COVID-19 patients in Europe declined from 54 years during January to May, to 39 in June and July. This is because of the opening up of economy



Doctors are getting better

Nearly 40 per cent of the people treated in ICUs till August in England, Wales and Northern Ireland died. The number has come down to 12 per cent after September 1



Positivity rates remain high

Most countries under second wave are testing only high-suspect people. At the same time, rapid tests have a low accuracy rate, which means many people are wrongly told they are free of the virus. So, the death numbers, calculated on confirmed cases, will be lower than the actual



Foggy superstructure

It is unclear how the new commission on air pollution will fit in the federal framework, but its formation asserts the role of the executive and limits the judiciary

ANUMITA ROYCHOWDHURY NEW DELHI

Recognising that air pollution requires action at the airshed level, the ordinance asks for a consolidated approach towards monitoring and elimination of pollution sources

ON OCTOBER 26, President Ram Nath Kovind signed an ordinance to form the Commission for Air Quality Management in National Capital Region and Adjoining Areas. This move, in one sweep, erases all other committees and authorities that were set up under judicial and administrative orders, and seeks to limit the role of the judiciary, creating a centralised, supra-framework for air-quality management. In its enhanced role and responsibility, curiosity abounds on how the executive will now move towards tougher decisions.

Recognising that air pollution requires action at the airshed level, the ordinance asks for a consolidated approach towards monitoring and elimination of pollution sources. The commission will have the power to coordinate with the Union and state governments on multi-sector plans, including those on industries, power plants, agriculture, transport, residential and construction (see 'New framework').

The critical departure, however, is the attempt to limit the role of the judiciary. The ordinance states that the commission is the "highest degree of democratic oversight for effective implementation" and will function under elected representatives with regular reports to Parliament. The implication of this superstructure for the federal framework is not yet clear. The ordinance states that, "No other individual, or body, or authority, constituted either under the law enacted by Parliament or by State government or nominated in terms of judicial order shall act upon or have jurisdiction in relation to the matters covered by this ordinance." It is not clear how the state governments in the region (Delhi,

Uttar Pradesh, Haryana and Rajasthan) will take decisions on mitigation or set higher level of ambition. Though the commission will include members from key Union ministries and states (officials of the level of secretary to the Government of India and chief secretary to the state governments), its power to issue directions and entertain complaints will be under Central political supervision. It is not yet clear how the states will respond to this.

SUPRA-GOVERNANCE

Everyone likes the idea of good governance and an effective executive. If this is an occasion to

redefine the role of the government and its enabling powers for the regional clean-up, it is important to consider what has stopped the executive from doing it till now under the current legislative framework (see 'New air pollution commission a cosmetic step' on p20). Were the Environment (Protection) Act, 1986, or the Air (Prevention and Control of Pollution) Act, 1981, not sufficient enablers for the clean air plans to get translated on ground at a scale and speed needed? Why did Delhi-NCR require judicial intervention?

Therefore there is a strong interest to know how the executive

TURN TO P22 ►►

NEW FRAMEWORK

The Commission for Air Quality Management in National Capital Region and Adjoining Areas will have powers to imprison defaulters and impose financial penalties

On November 5, the government published the names of the first Commission for Air Quality Management in National Capital Region and Adjoining Areas in the Gazette of India. The 15-member commission, headed by M M Kuttly, former secretary to the ministry of petroleum and natural gas, includes chief secretaries of states in the National Capital region (NCR), independent air pollution experts, representatives from non-profits, and technical experts from the Central Pollution Control Board, the Indian Space Research Organisation and the NITI Aayog.

The Commission for Air Quality Management in National Capital Region and Adjoining Areas Ordinance, 2020, provides for setting up of the commission to improve identification, research and resolution of issues that impact air quality in NCR and the neighbouring states of Punjab, Haryana, Uttar Pradesh and Rajasthan. Headquartered in Delhi, the commission will have powers to curb activities that affect air quality, prepare guidelines to check air pollution and issue orders to concerned individuals or authorities. Failure to comply with the commission's orders will invite a fine of up to ₹1 crore or a jail term up to five years or both. The National Green Tribunal will hear appeals against the commission's orders.

The chairperson and the members of the commission are appointed on the recommendation of a selection committee, headed by the environment minister. The selection committee includes the cabinet secretary, commerce and industries minister, road and transport minister and minister of science and technology. The chairperson and the members will serve for a term of three years or up to the age of 70, whichever is earlier.

'New air pollution commission a cosmetic step'



Mahesh Chandra Mehta has an old connection with the national capital and its fight against pollution. It was his public interest petition, filed with the Supreme Court in 1985, that led to formation of several judicial committees over the years and resulted in complete switch to compressed natural gas in public transport in 2001. Speaking to **Vivek Mishra**, Mehta says the Centre's ordinance to set up a new commission on air pollution in Delhi-NCR, dissolving the judicial committees, discounts the commendable job that these bodies have done. Excerpts:

How effective will be the new commission in preventing air pollution in the Delhi-National Capital Region?

While the world is faced with an epidemic, the time is not suitable for the formation of a new commission. Legal provisions to control air pollution already exist in the Air (Prevention and Control of Pollution) Act, 1981, and the Environment (Protection) Act, 1986. They just need to be implemented effectively. If it is assumed that the earlier laws were weak, then the governments should answer whether it was able to implement even those weak laws. If the Supreme Court and the High Court had not interfered, or if we had not had judicial authorities and committees that the courts constituted, we would not have seen even 10 per cent of the work on air pollution

control in this country. The formation of the new commission is a cosmetic approach—old wine in a new bottle.

How do you see the commission working in place of the Environment Pollution (Prevention & Control) Authority (EPCA) and other committees set up by the Supreme Court?

It is extremely important for all independent judicial authorities and committees to remain functional because they have been doing a very important and commendable work.

You have been in many judicial committees on air pollution. What is your experience?

First of all, governments in the country have not been sensitive to the environment. They believe more in protecting the interests of polluters. This has been my experience since 1985, when the issue of vehicular pollution reached the Supreme Court. Take the case of the Justice K N Saikia Committee formed by the Supreme Court on 14 March 1991, of which I was a member. The committee submitted 17 reports, which have not been implemented. Even efforts to run vehicles on compressed natural gas were strongly opposed. For example, it was said that the vehicles would explode or catch fire. But today you can see the effect of that judicial effort. The Bhure Lal Committee also continued to submit excellent reports but nothing happened.

The ordinance states it will ensure the participation of the NCR states. Were the earlier committees confined to Delhi?

This is not the case. The fight has been for the whole country. The orders and directives of the courts have always been for NCR and surrounding cities. In the case of stubble burning, the various governments keep blaming each other but no action is taken on the defaulters who keep

burning garbage mountains in Delhi. Moreover, have the Central Pollution Control Board or the state control boards and committees failed? If they have, they should be given an opportunity to explain why. There were political appointments to these bodies which made them disoriented. If the same happens with the new commission, air pollution, too, will continue.

Judicial committees submitted reports to the courts, while the new commission will submit reports to Parliament.

There is nothing new in this. All the Standing Committee Reports of Parliament are full of suggestions that have not been implemented. In the case of Agra Taj trapezium zone, the recommendations of the Standing Committee have not been implemented till date. Many members of Parliament have been raising these issues in the House. That, combined with judicial retribution, at least helped in getting some work done. Now, the commission will keep submitting reports and the members of Parliament will keep accepting them. Who will be responsible for the deaths of the children and the elderly due to air pollution while this happens?

The ordinance allows the new commission to jail defaulters for five years or impose a fine of up to ₹1 crore.

The Environment (Protection) Act, 1986, already provides for a five-year sentence and a fine of up to ₹1 lakh or a ₹5,000 per day. The Air (Prevention and Control of Pollution) Act, 1981, also provides for a jail term and financial penalty. To say that features of the new commission will help prevent air pollution is just wishful thinking. Everything depends on implementation. Clean diet, clean air and clean water are the basic rights of people and the governments failing to ensure them are violating not only people's basic rights but also their right to life.

IF WE ASSUME THAT THE EARLIER LAWS WERE WEAK, THEN THE GOVERNMENTS SHOULD ANSWER WHETHER THEY WERE ABLE TO IMPLEMENT EVEN THOSE WEAK LAWS

will now push for the solutions that are much tougher than the low-hanging fruits already picked. The action taken so far (and some of these were tough) could be implemented only with the backing of the Supreme Court based upon the Fundamental Right to Life, among others. Even measures recommended and monitored by the Supreme Court-appointed Environment Pollution (Prevention and Control) Authority (EPCA) and backed by Supreme Court directives have faced resistance, often slowing down action. These include:

- Mandatory use of compressed natural gas (CNG) for public

would be to know how the executive can push urgent solutions, speed up sectoral reforms and investments and ensure effective compliance and a deterrence framework.

TOUGHER ACTION NEEDED

The real challenge for the executive at this crossroads is its preparedness and ability to push for the difficult and inconvenient solutions to reduce particulate pollution by at least 60 per cent to reach national ambient air quality standards. How will this happen?

The Supreme Court had advanced the deadline to implement stricter power plant standards to

NCR is also awaiting massive transition in public transport connectivity, walking and cycling infrastructure and vehicle restraint measures. It was a battle so far for EPCA to get the Union and state governments to agree on RRTS and the Phase IV work of Delhi Metro. There is no framework or roadmap for this sector.

Similarly, why would waste burning stop if all the state governments could not make municipalities amend bylaws based on the Central rules and regulations for waste management and allocate sufficient funds for the required infrastructure?

Even more interesting would be to see the compliance and deterrence framework. At this moment, the ordinance has provided for the right to inspect, as well as penal action for non-compliance, that includes imprisonment up to five years or a penalty of ₹1 crore.

Criminal prosecution is possible if the commission complains. So far, nationally, criminal prosecution under the Air (Prevention and Control of Pollution) Act, 1981, has been the toughest to implement. This will require establishment of vertical and horizontal accountability across the region.

Also, special care is needed in the post-COVID-19 times to ensure that “ease of doing business” policy and automatic consent do not subvert environmental governance and that there is a green economic recovery strategy for the region.

The move brings attention to the public health crisis that it deserves. But the expectation, clearly, is that the executive will live up to the new challenge and succeed in implementing the tough solutions needed to clean up the air and the lungs. [DTE](#) [@AnumitaRoychowdhury](#)

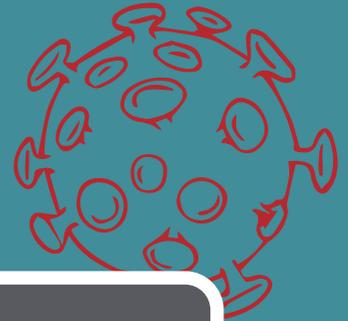
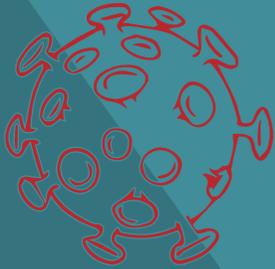
AS THE COMMISSION TAKES THE AGENDA FORWARD, IT WILL BE INTERESTING TO KNOW HOW THE EXECUTIVE CAN PUSH URGENT SOLUTIONS, SPEED UP SECTORAL REFORMS AND INVESTMENTS, AND ENSURE EFFECTIVE COMPLIANCE WITH A DETERRENCE FRAMEWORK

transport in Delhi;

- Ban on entry of pre-2006 manufactured trucks in Delhi and restriction on transit trucks from entering the city;
- Closure of coal-based power plants in Delhi;
- Clean fuel policy and the banning of dirty petcoke and furnace oil (leading to country-wide introduction of oxides of nitrogen, or NOx, and sulphur standards for industries);
- Early introduction of Bharat Stage VI fuels;
- Bus augmentation plan for Delhi
- Facilitating Regional Rapid Transit System (RRTS) for NCR and Phase IV of the Delhi Metro; and
- Framing a parking policy as per the traffic demand.

As the commission now takes the agenda forward, the interest

2019 in NCR. Can we now expect quashing of the plea to delay the implementation of the power plant standards? Only a few weeks ago, the Union environment ministry diluted the NOx emissions standards for power plants. The executive will now also have to design the economic recovery package for the sector linked to power distribution companies (Discoms) and work on electricity pricing reforms, closure of old plants and make investments in pollution control technologies bankable, while incentivising the process. Can we now expect the Union government to bring natural gas pricing under the Goods and Services Tax to enable industry and power plants to have access to affordable clean fuels and address coal effectively?

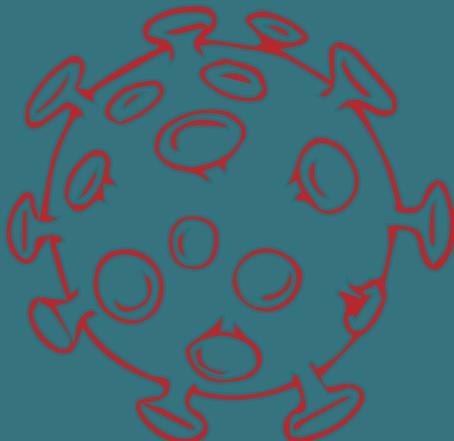
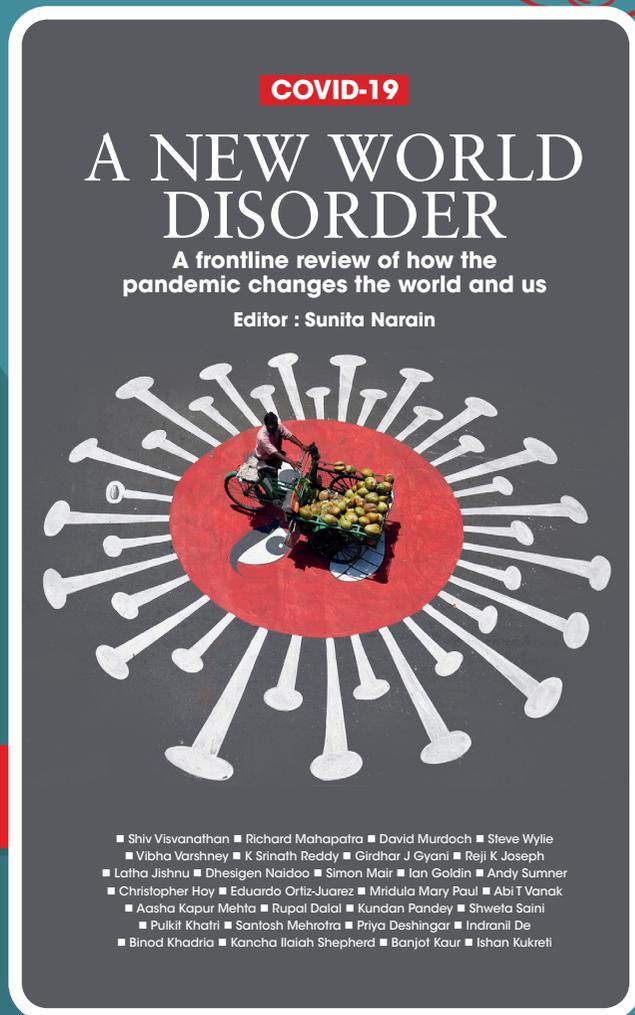


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Third tier or third wheel?

Newly constituted District Development Councils in Jammu and Kashmir have triggered fears of dilution of grassroots democracy in the Union Territory

RIYAZ WANI SRINAGAR

IN THE first major legislative change after Jammu and Kashmir became a Union Territory, the Union government has announced creation of District Development Councils (DDCs)—district-level self-governing bodies. On October 17, the Union government amended the Jammu and Kashmir Panchayati Raj Act, 1989, and the Jammu and Kashmir Panchayati Raj Rules, 1996, to create DDCs; and on November 4, State Election Commissioner K K Sharma declared that elections to DDC will be held on November 28. All major parties have agreed to participate in the election, though they are unhappy with the creation of DDCs.

Unlike any other part of the country, every district in Jammu and Kashmir (J&K) will be divided into 14 territorial constituencies which will elect members to DDC. The members will then elect chairperson and vice-chairperson who will administer the district. DDC will have complete jurisdiction over the district except the areas controlled by a Municipality or Municipal Corporation. Though Members of the Legislative Assembly (MLA) and chairpersons of Block Development Councils (BDCs) will also be in the DDC, only the 14 elected members will have the

power to elect or remove the chairperson and the vice-chairperson.

According to the Central government as well as the J&K administration, the move will empower democracy at the grassroots level. Under the prime minister, “a path-breaking step, to set up, for the first time, district development councils” has been taken, tweeted Jitendra Singh, minister of state for the Prime Minister’s Office. The J&K administration too termed DDCs “as

a constitutional requirement under the 73rd Amendment” that provides for a uniform three-tier Panchayati Raj at village, intermediate and district levels.

CUTTING GRASSROOTS

The move, however, is widely seen as nullifying the role of the established Panchayati Raj institutions of gram panchayats and BDCs. “We already had a Panchayat system in place, with its



members elected by the voters. That system has been sidelined. The villages will have no say,” Shafiq Mir, president of All J&K Panchayat Conference, and chairman of a Block Development Council in Poonch district, told *Down To Earth*. “DDC will exclusively control the development activities in the district while Panchayat and BDC members will have to compete for power with DDC members,” he says. “In

every territorial constituency in a district, there will be a sarpanch and one or two BDC members, besides a DDC member. How will there be a consensus over development work?” Mir says.

Within a DDC, since the MLA and BDC chairpersons will be subservient to the elected members, how will their opinion matter? he asks.

In the earlier Panchayati Raj system in J&K, there was a three-tier system in place, but only the panch and the sarpanch were directly elected. They then elected BDC chairpersons who, in turn, formed the District Planning and Development Board. In an order passed on August 2, the government abolished the District Planning and Development Board across J&K.

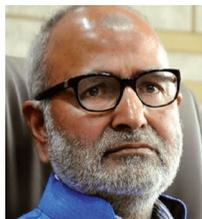
PANCHAYAT, BDC POLLS

The last elections to Panchayats in J&K were held in 2018, but they were poorly participated in because of the boycott by mainstream parties like the Jammu and Kashmir Peoples Democratic Party (PDP) and the National Conference. In October last year, just two



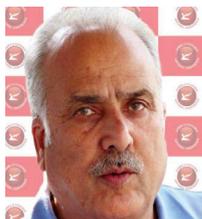
“District Development Council will exclusively control developmental activities. Where does this leave gram panchayats and block development councils?”

— **Shafiq Mir**
President, All J&K Panchayat Conference



“The attempt is to ensure that there is no credible voice that speaks for whole of J&K”

— **Naeem Akhtar**
Member, Jammu and Kashmir Peoples Democratic Party



“District Development Councils will dilute democratically elected institutions”

— **Hasnain Masoodi**
Member, National Conference, and Member of Parliament, Anantnag

months into the revocation of Article 370, the J&K government held the first-ever elections to BDCs. As many as 1,065 elected Panchayat members contested for 285 BDC seats in Jammu and Kashmir. But

after the elections, the government kept delaying the formation of District Planning and Development Boards. As it turns out, the administration had other plans, as the recent decision to form the DDCs shows.

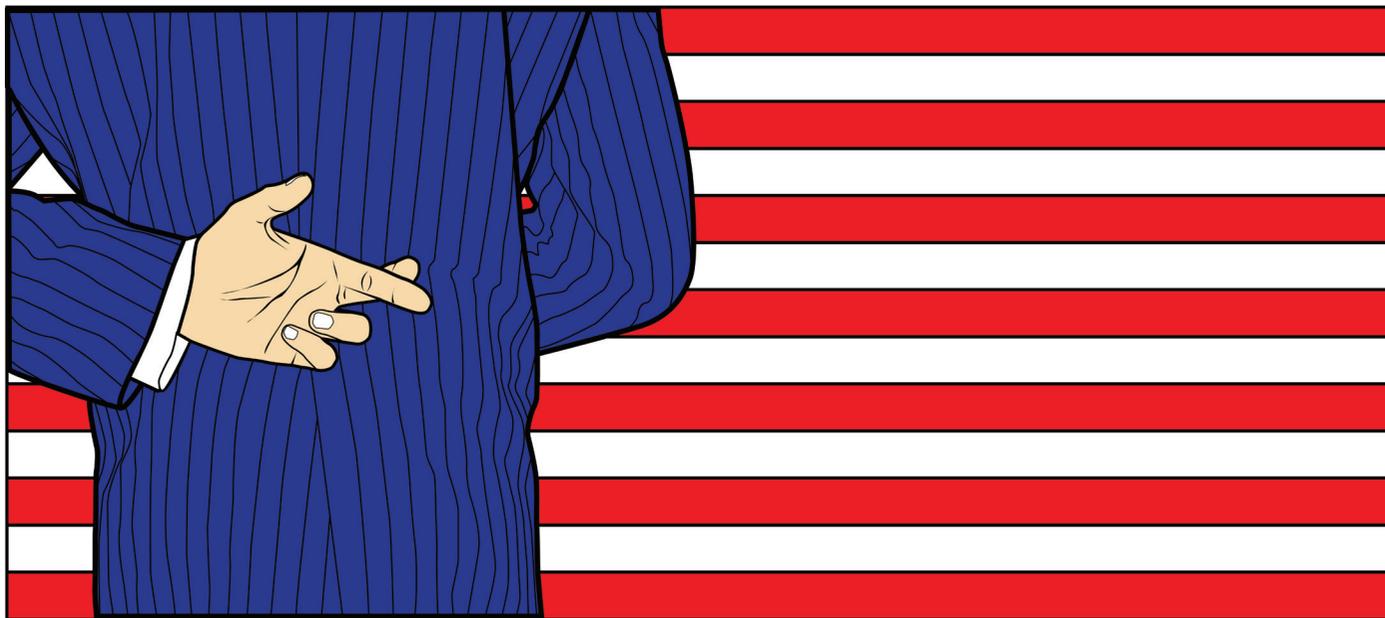
POLITICAL OPPOSITION

The decision to create DDCs has received severe opposition from political parties, who say the move is designed to supplant local politics. It is a step to depoliticise Kashmir and hand the real authority to bureaucrats and security agencies, says Naeem Akhtar, senior leader of PDP. “The attempt is to ensure that there is no credible voice that speaks for the whole of J&K and the representatives who can do so, like MLAs, are being rendered powerless,” he says. The National Conference has expressed similar views. Its Member of Parliament from Anantnag, Hasnain Masoodi, says the exercise is “to deny space to politics under the guise of strengthening grassroots democracy”.

“Changes to the grassroots empowerment laws are taking place at a time when J&K has no Assembly,” says Naseer Ahmad, a Srinagar-based author. “There is also no word about restoration of statehood,” he adds. Though Home Minister Amit Shah, in a recent interview, indicated a near restoration of the statehood, it looks unlikely that the Centre will do so any time soon.

“DDCs are being set up as an alternative to an elected government,” Ahmad says, “but they can hardly replace an elected government which alone has a political function and can represent the broad grievances and aspirations of the people.” **DTE**

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Fingers crossed

Undoing the damage caused by Donald Trump may be Joe Biden's first step, but the climate challenges that the US faces today are daunting

AVANTIKA GOSWAMI AND SHAZNEEN CYRUS GAZDAR

DURING HIS victory speech, US President-elect Joe Biden announced that climate change would be one of his top priorities, adding that Americans must “marshal the forces of science in the battle to save our planet”. He has vowed to rejoin the landmark the Paris Agreement as soon as he assumes office. In fact, in June last year, Biden had said that he had plans for a \$1.7 trillion investment in a green recovery, which would reduce US emissions by about 75 gigatonnes over the next 30 years.

Biden has also said he would stop leasing any new oil and gas rights on federal land and water. He could also direct agencies to tighten emissions standards for the electricity sector, to push it toward his goal of net zero emissions. And he could raise fuel economy standards for cars and trucks to speed up a transition to electric vehicles (see ‘Biden will restore climate change and climate policy’, p27).

But a 180° turnaround on environment and climate change issues for the US will not be easy for Biden, post-Trump. First, any push for climate action will require Democrats take control of the US Senate. Second, in the four years he was president, Donald Trump relaxed more than 150



climate-friendly regulations—tail-pipe emissions, endangered wildlife and rainforest protection among others—and this will take considerable time for Biden to undo the damage.

Third, fracking—hydraulic fracturing in the shale formation to release gas—is a contentious issue. It is opposed by climate advocates for the volume of water and toxic chemicals consumed by the process and the contamination threat to drinking water sources. But Biden has historically been known for his deep involvement in the shale oil boom during the Obama years. So we can expect little action from Biden on banning fracking.

Though Biden had earlier vowed to get other countries to make more ambitious targets to keep global warming to a maximum of 2°C, in a post-Trump world, the bar for the US to participate as a climate leader in international negotiations has become very low. The country is set to miss its Paris commitment to lower carbon emissions by 26-28 per cent below 2005 levels

“Biden will restore climate science and climate policy”

JOHN P HOLDREN was senior advisor of science and technology to President Barack Obama. He spoke to **DOWN TO EARTH** on what Joe Biden will do to tackle climate change and other environmental issues

WITH A Biden Presidency, there is some optimism. On Jan 20, 2021, when Joe Biden will be sworn in as the 46th President of the US, he is expected to launch a series of strong actions on climate change. In his speech, President-elect Biden mentioned, he believes and follows the science on climate change. This is especially pertinent, in a background of increasingly alarming scientific evidence of carbon dioxide emissions. The thawing permafrost from the rapidly warming Arctic indicates that these emissions alone may make it impossible to meet the internationally agreed target of holding the increase of global warming to 2°C above pre-industrial levels.



A fundamental step Biden would take is to restore climate science and policy personnel across all executive branches related to climate change and climate science such the Environmental Protection Agency, the Department of Interior, the Department of Agriculture and the Department of State. All of these critical departments have suffered very serious reduction in personnel under Trump—people have left or have been fired. He would rejoin and reinvigorate Mission Innovation. This is the compact arrived at by the Heads of State at the very beginning of the Paris Agreement in which the 20 countries—responsible for 85 per cent of government investment in clean energy technology around the world—agreed to double those investments in clean energy technology over a period of five years. Ever since assuming office, Trump had been trying to reduce investments in clean energy technology and, therefore, there is a dire need to restore the US engagement in Mission Innovation. The Biden administration will also begin to reconstruct the badly-damaged effort on climate change adaptation, preparedness and resilience across all the executive branch departments, agencies and offices. This includes the harm to human health, economies and ecosystems.

The top priorities in the next months of the Biden administration will include bolstering climate change monitoring and assessment, making more diverse, continuous and pervasive measurements with an improved sweep of ground-based, ocean-based, airborne and satellite systems. This is to improve upon the understanding of regional impacts, differences in the way climate change impacts human wellbeing in different regions of the world. This information is essential to sensible adaptation policy.

He will rebuild cooperation with other countries in clean energy, climate change science, adaptation, preparedness and resilience. Biden understands that global climate change is a problem that requires everybody's participation and cannot be handled by any single or even a group of countries. It is a planetary challenge that requires a global solution, requiring action from the majority of the countries of the world, including the biggest emitters. Having worked closely with Biden on these issues, it is apparent that he has a thorough understanding of the science and the need for action. Biden and vice president-elect Kamala Harris are both deeply committed to getting the US back on track on the climate change discourse.

Then and now

How Joe Biden and Donald Trump differ on various climate issues



		Joe Biden	Donald Trump
Climate plan		\$2 trillion climate plan; targets Net Zero by 2050	Trump had no climate plan
Fossil fuels		Does not support a fracking ban, wants to end fossil fuel subsidies	Pushed policies to back the coal industry despite its imminent decline
Renewable energy		Committed to renewable energy; pledged 100% clean electricity by 2035	Claimed wind energy kills birds and solar energy "doesn't quite have it yet"
The Paris Agreement		Supported Obama in joining the Agreement in 2015; pledged to rejoin	Withdrew from the Paris Agreement
Environmental regulations		Wants to reinstate fuel efficiency standards; strengthen pollution laws	Rolled back over 150 climate-friendly regulations
Climate justice		Committed to giving 40% of climate investments to disadvantaged communities	No acknowledgement; denied relief funds to states suffering from climate disasters
Climate science		Pledged to listen to climate scientists	Denied climate change, scrubbed climate change from government websites
Green New Deal		Has not endorsed the Green New Deal, but drawn elements from it in his climate plan	Has not endorsed the Green New Deal, thinks it will kill millions of jobs

through 2025.

In fact, the US is ranked lowest on the Climate Change Performance Index, published by Germanwatch, the New Climate Institute and the Climate Action Network in 2020. Worse, in addition to being the world's largest historical emitter, the US is also currently the largest per capita emitter of greenhouse gases (GHGs). In fact, net US GHG emissions in 2019 were higher than at the end of 2016 (see 'Biden's transformational challenge', p3).

RECLAIMING LOST GROUND

For Biden, regaining credibility will be the most important challenge. Biden needs to not only put his country's house in order, but must also focus on bringing the US back on the negotiating table and provide a clear momentum for United Nations Framework Con-

vention on Climate Action's (UNFCCC) Conference of Parties-26 next year in Glasgow. Here, Biden will have the opportunity to steer the ship on course to some extent and also join other countries like China and Japan in setting a Net Zero target.

Moreover, the US needs to also pay its fair share to poorer developing countries on adaptation and mitigation of climate change. But given Biden's centrist neoliberal political leaning, he will favour market-based approaches and heavy private sector involvement in

REGAINING CREDIBILITY IS THE MOST IMPORTANT CHALLENGE FOR BIDEN. THE US MUST PAY POORER COUNTRIES ON MITIGATION TO CLIMATE CHANGE AS IT IS HIS COUNTRY'S FAULT

climate action, rather than transformative government-led overhaul that is needed.

On the health front, Biden has vowed to reverse Trump's decision to withdraw from the World Health Organization. Trump had accused the UN agency of conspiring with China to downplay the infectiousness of the novel coronavirus. Global health experts are counting on Biden to restore and re-imagine the US' relationship with the world's leading public health agency.

He could also use trade deals and other international agreements to pressure countries to reduce their own GHG emissions, drive clean energy technology or limit deforestation. "The relationship must be completely reset," says Rifat Atun, a professor of global health systems at Harvard University. **DTE**

@down2earthindia



TREE PLANTATION DRIVE

According to the **Global Risks Report 2020** by the World Economic Forum, the repercussions of climate change are striking harder and more rapidly than expected. Environmental risks now top the risks agenda.

Himalaya has always worked towards preventing the loss of biodiversity and has been committed to preserving nature. We have rolled out many initiatives in this direction, and our tree plantation drives are the most crucial part of this endeavor. Till date, we have planted **7,90,000** saplings across the **Western Ghats, Eastern Ghats, and Khasi Hills**.

We work at the grassroots level by collaborating with partner organizations like **Society for Environment and Biodiversity Conservation (SEBC)**, **SYNJUK**, and the local communities and other stakeholders to help us understand the terrain better to plant indigenous species and ensure the survival of **75%** of the saplings.

Forest reforestation is vital to mitigate the current threat of rising greenhouse gases, climate change, and the loss of biodiversity. Through these efforts, **Himalaya** is focusing on creating a sustainable future.





AGE OF VIRUS

The much-scorned, dreaded
biological entities are
also the highly
misunderstood beings

**SNIGDHA DAS,
BANJOT KAUR
AND
ISHAN KUKRETI**

ONCE UPON a time, just as life was taking shape on Earth, there was a free-roaming cell. It was fiercely independent. As time passed, it developed an intimate relationship with another of its kind, which predated LUCA—the last universal cellular ancestor. In the beginning, the relationship was symbiotic. But over the period, as the forefather of LUCA embarked on a journey to acquire complex traits, the primitive roamer opted for a simpler, parasitic life. So much so, that one by one it started renouncing its genes, essential for supporting life, until it was left with a few strands and became indistinguishable from the non-living. Eventually it was unable to replicate independently and accepted the fate of an obligate intracellular parasite—a virus.

Some scientists would like to narrate this story, of the origin of virus, a little differently. They would like to start from the forefather of LUCA that possessed mobile genetic elements—pieces of genetic material capable of moving around within a genome. This characteristic continues to be part of the modern cell; in fact, in humans about 50 per cent of the genome is thought to be mobile elements. At some point, some of the genome of this primordial cell—forefather of LUCA—acquired a few structural proteins and gained the ability to exit the cell and spread as an infectious agent, or a virus.

Both the narrations are based on the assumption that cells existed before viruses. What if it's the other way round? Some scientists postulate a scenario in which viruses existed in a pre-cellular world as self-replicating genetic elements—RNA (ribonucleic acid) or DNA (deoxyribonucleic acid) molecules. Over time these units, became more organised, complex and even synthesised proteins required for the formation of their shell, known as capsid.

In that case, viruses may have existed before their hosts in any of the three

domains of life form—bacteria and archaea (groups of primitive prokaryotes that do not have a true nucleus or membrane-bound organelles but exhibit distinct characteristics) or multicellular eukaryotes, which include humans.

What if viruses co-evolved with these domains or super-kingdoms? What is evolution of life is actually the story of virus-host co-evolution? Last year, writing in *Nature Reviews Microbiology*, some scientists have proposed that new groups of viruses have repeatedly emerged at all stages of the evolution of life, often through the displacement of ancestral structural and genome replication genes. (See 'Theories on origin of virus'.)

Such questions, theories and their variants continue to confound scientists even as they are engaged in the biggest war of our times—the ongoing pandemic caused by SARS-COV-2 continues unabated for about a year now, killing 1.26 million people worldwide and with no definitive cure in sight. In fact, our knowledge of viruses have not evolved much in the past 11,000 years, since these smallest and simplest biological entities carried out their first mass killing in history.

That was the time when our nomadic ancestors had taken up farming and were adjusting to settled life. Rodents, that are natural carriers of several viruses, were becoming part of their immediate ecosystems due to easy availability of grains. (It might be an evolutionary milestone for them as well.) A virus usually prefers limiting itself to the population of a particular species. But somewhere during this frequent interaction with rodents, one poxvirus crossed the species barrier and jumped to humans. It was a landmark event, but with lethal consequences. The pox virus caused smallpox, one of the deadliest viral infections in humans. Over the subsequent years, the virus travelled with humans across the globe killing millions. Fatality was very high as we didn't have immunity against this "novel"



Ebola
Endemic areas
West Africa

Scare factor
A rare but severe, illness with a **case fatality** rate of over **50 per cent**

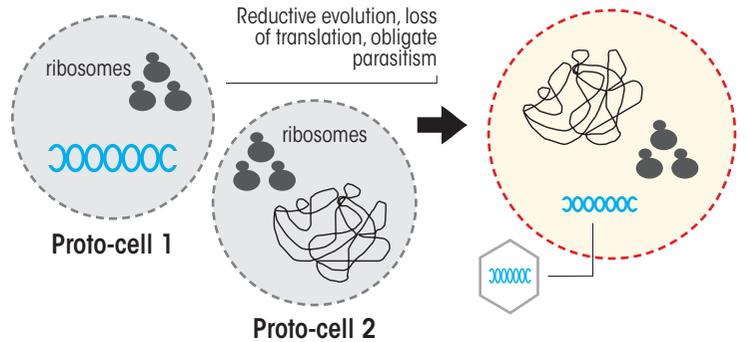


Yellow fever virus
Endemic areas
Africa, Central and South America

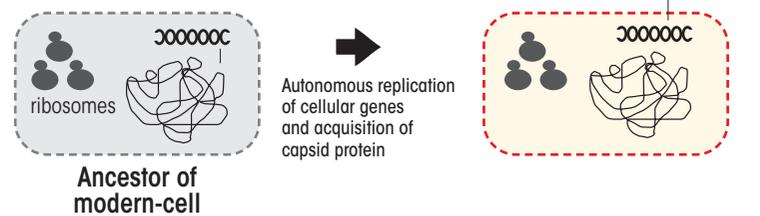
Scare factor
Acute haemorrhagic disease transmitted by **infected mosquitoes**. The "yellow" refers to the **jaundice** that affects some patients

Theories on origin of virus

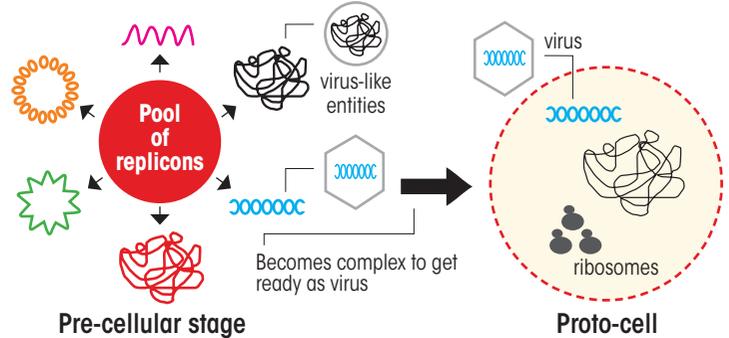
Regression hypothesis: Viruses emerged through the degeneration of cells that then assumed a parasitic lifestyle



Escaped genes hypothesis: Cellular genes acquired the ability for replication and escaped as infectious agents



Virus early hypothesis: Viruses evolved from early genetic elements, or replicons, that were present in the dawn of evolution

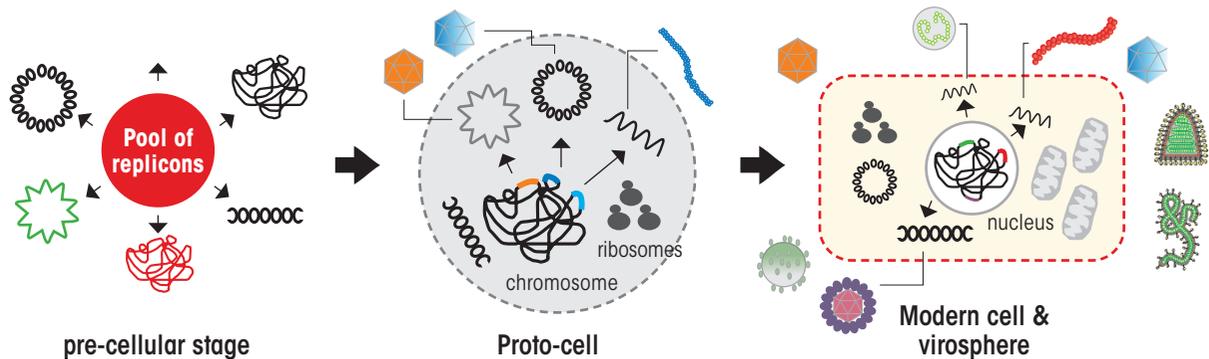


pathogen. In 1980, following an historic global campaign of surveillance and vaccination, the World Health Assembly declared that smallpox has been eradicated—the only infectious disease against which this distinction has been achieved—but nobody knows for sure whether the virus has ceased to exist.

Millions of years of evolution has caused spectacular changes in our life, but what remains a constant is the occurrence of diseases. And viruses cause most of them, at least the ones that kill the most. Over 150 million people have been killed by diseases caused by viruses in the last one century. Yet we did not acknowledge its existence until the late 19th century. In fact, in 1796 when Edward Jenner created the world's first vaccine to cure smallpox, he had no idea about the existence of virus.

What's strange is that the first evidence of the existence of viruses came while studying plant diseases, not diseases in humans. In 1857, the Netherlands witnessed a strange contagious disease, affecting up to 80 per cent of the tobacco crops. It took over 20 years for scientists to start studying it. In 1879, plant pathologist Adolf Mayer named it the "mosaic disease of tobacco".

Chimeric scenario: Selfish replicators emerge before first cellular life forms, capture capsid protein genes from cellular organisms, and form virions. Continuing evolution and adoption of cellular genes contribute to diversification of the virosphere.



Protocells are precursors to modern living cell; Ribosomes are molecular machines present in living cells to synthesise protein; Replicons are simple molecules that appeared in the dawn of evolution and were capable of replicating themselves

Source: M Krupovic, Valerian Dolja, Eugene Koonin. Origin of viruses: primordial replicators recruiting capsids from hosts. Nature Reviews Microbiology, Nature Publishing Group, 2019, 17 (7), pp.449- 458. 10.1038/s41579-019-0205-6. pasteur-02557191

But he was not able to identify the pathogen as there was no instrument to spot it. That was the first hint that a new and extremely tiny pathogen, much smaller than the microscopic bacteria, could be causing the disease. Then scientists used to employ filtering methods to identify bacteria, but the new pathogen slipped out of these filters.

In 1889, over three decades after studies began on mosaic disease, Dutch microbiologist and botanist Martinus W Beijerinck published his findings, which say the disease agent needed growing leaves to multiply or to infect other plants. Second, when he checked newly

infected leaves, he found that with fresh infections the disease agent did not lose its disease-causing power. His conclusion was: the agent could grow on leaves but could not reproduce without them. He named this agent as “contagium vivum fluidum”, or a “contagious, living fluid”. He also gave it a nickname, “virus”. Thus, tobacco mosaic became the first virus to be discovered.

Half a century later in the 1940s, American biochemist, virologist Wendell M Stanley created a crystallised sample of the tobacco mosaic virus that could be seen using X-rays. In 1941, with advancement of the electron microscope, we for the



Dutch microbiologist and botanist Martinus W Beijerinck (bottom) founded the discipline of virology with his discovery of viruses. American biochemist Wendell M Stanley (top) for the first time demonstrated the molecular structure of a virus. He was awarded the Nobel Prize for his research on virus.

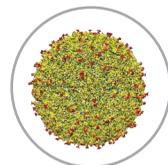
first time saw a virus; the tobacco mosaic virus was rod-shaped, with just five genes and protein. A few years later, Stanley shared the Nobel Prize in Chemistry for creating the crystallised sample. “The way we use ‘virus’ today, he was the first one to bring that term to us in a modern context, and I would give him credit for the beginning of virology,” says plant virologist Karen-Beth Scholthof of Texas A&M University, US.

In humans, the virus causing yellow fever was the first one to be described. After pioneering work in Cuba by epidemiologist Carlos Finlay in 1881, who hypothesised that mosquitoes transmitted the disease, US Army physician Walter Reed in 1901 confirmed how the disease spreads and said that it was caused by a filterable agent found in the blood of infected patients. It took another quarter of a century for scientists to understand that “filterable agent” and isolate the virus. However, the doubt over the existence of virus continued for long. Even during the Spanish Flu (1918-20), the deadliest pandemic of recent century that killed an estimated 50 million people, the medical fraternity believed that it was caused by bacteria.

VICTIM OF MYOPIA

The major roadblock in understanding virus has been scientific myopia. Scientists for long dismissed it as an arrangement of materials because of its small size and simple structure. Poliovirus has a diameter of 25 to 30 nanometers (nm), roughly 10,000 times smaller than a grain of salt, and has one RNA strand. Larger spherically shaped influenza virus is of 80 nm in diameter, with eight RNA strands. A typical brick-shaped poxvirus may be 200 nm wide and 300 nm long and has a double stranded DNA genome.

To be termed alive an entity must have a few non-negotiable properties. It must have the capacity to grow, reproduce, have internal homeostasis or the ability to maintain a relatively stable internal

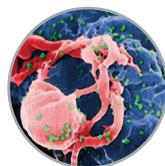


Zika

Endemic areas
86 in Africa, the Americas, Asia and the Pacific

Scare factor

Can be passed from a **pregnant woman to her foetus**, leading to **birth defects**. A vaccine is yet to be developed



HIV

Endemic areas
Global

Scare factor

Causes AIDS and **interferes** with the body's **ability to fight infections**. Without an effective cure, **once people get infected, they have it for life**

state that persists despite changes in the world outside, and the ability to perform various metabolic processes. Viruses do not have these properties. They do reproduce but they need host cells for replication.

But usurping the host's metabolic capacity to produce a new generation of virions, essentially virus particles, which go through the next cycle of reproduction, is a smart strategy. What if this is a way living for viruses?

One can understand this only by untangling the lineage of a virus. But it's not easy. Since viruses are nothing more than a few short strands of RNA or DNA wrapped in a soft protein shell, they cannot leave behind physical fossils. But viruses do leave a footprint—sometime they transfer their own genes to the host cells while replicating. These genetic codes preserve information from millions of years ago. But Gustavo Caetano-Anollés, who is an expert in the field of evolutionary and comparative genomics and teaches bioinformatics at the University of Illinois at Urbana-Champaign, US, says sequences that encode viral genomes are subject to rapid change. Their high mutation rates can obscure deep evolutionary signals. He and his colleagues have thus been trying to retrace virus' footprints by analysing folds on its protein shell or capsid.

Caetano-Anollés says these protein folds are better markers of ancient events because their three-dimensional structures can be maintained even as the sequences that code for them begin to change. Using computational methods, he and his colleagues have analysed all of the known folds in 5,080 organisms representing every branch of the tree of life, including 3,460 viruses. They have identified 442 protein folds that are shared between cells and viruses, and 66 that are unique to viruses. Their finding shows that the genomes of viruses harbour an abundance of well-characterised virus-specific genes and encode numerous protein structures that

carry significantly deep evolutionary information about a pervasive virus-to-cell genetic transfer of cellular innovations. Thus, viruses should be considered drivers of cellular evolution rather than minimalistic genetic parasites. They have played and continue to play major roles in the evolution of the living world, the researchers write in the August 3, 2020 issue of *Archives of Virology*.

The theory that viruses are living has received support since the discovery of giant viruses in 2003. Today, dozens of giant viruses have been discovered inhabiting a wide range of environments. Their virions, vehicles of transmission that embed the genetic material of the virus with a capsid (protein shell) and a lipid envelope, are cell-like and large enough to be visualised under a light microscope. They can produce thousands of proteins, including proteins involved in hijacking host metabolism and translation. These and other features (some cell-like) were previously never thought to be associated with viruses. Caetano-Anollés, too, suggests that these giant viruses are “living” parts of complex cellular cycles and together, with other viruses make up an additional supergroup or a fourth domain of life. Alive or not, there is no argument that viruses affect the living.

WELCOME TO VIROSPHERE

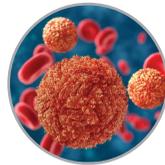
The world of viruses is dense and vast. Its diversity is greater than the world that we know and interact in. Viruses are omnipresent, found in air, land, sea to every species to even in every body parts. “An estimated 10 nonillion (10 to the 31st power) individual viruses exist on our planet—enough to assign one to every star in the universe 100 million times over,” writes the *National Geographic*.

Some believe that viruses have initially formed with RNA genome. Today, they have a variety of mix-and-matches of genetic materials. Some viruses like poliovirus, have RNA genomes, while the

others like herpesvirus have DNA genomes. Some viruses have single-stranded genomes, while the others, like smallpox, have double-stranded genomes. They also replicate differently. According to a study by scientists of the University of British Columbia, Canada, “almost all of the life in the oceans, by weight, is prokaryotic (bacteria and archaea), with viruses and protists making up roughly equal amounts of the remaining.” If one measures by biomass, giant sea creatures like whales would even not compare with those of the viruses. As the study by the British Columbia scientists project, “There are about 200 mega tonnes of carbon in viruses in the ocean, which is equal to about 75 million blue whales. The most biomass that was ever in whales, as far as we know, was about 13 mega tonnes. These numbers are dwarfed by the carbon in prokaryotes, which is 5.2 gigatonnes.”

Curtis A Suttle, a scientist at the university, has been researching the virus diversity in oceans. His findings and inferences unfold a magical world before us. Suttle has found that “in a litre of coastal seawater there are more viruses than there are people on the planet”. On an average, there are about 10 million viruses and a million bacteria per litre of seawater or freshwater. “If we compare the number of viruses in the oceans to the number of stars in the universe, there are about 10^{23} stars in the universe. In contrast, there are about 10 million-fold more viruses in the ocean than there are stars in the universe.” If one arranges the total viruses in the oceans end-to-end, it would be a length of 10 million light years.

Suttle says, these viruses are responsible for Avogadro’s number, about 10^{24} infections per second in the ocean. Each one of these events is an opportunity for lateral transfer of genes. Most of the genetic information on Earth probably resides within viruses.



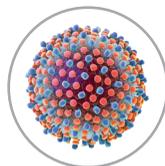
Dengue

Endemic areas

Asia, Latin America

Scare factor

Global incidence has grown dramatically in recent decades and about **half** of the world’s population is now **at risk**



Hepatitis C

Endemic areas

Global

Scare factor

Slowly damages the **liver** over many years, often progressing from inflammation to permanent, **irreversible scarring** or cirrhosis

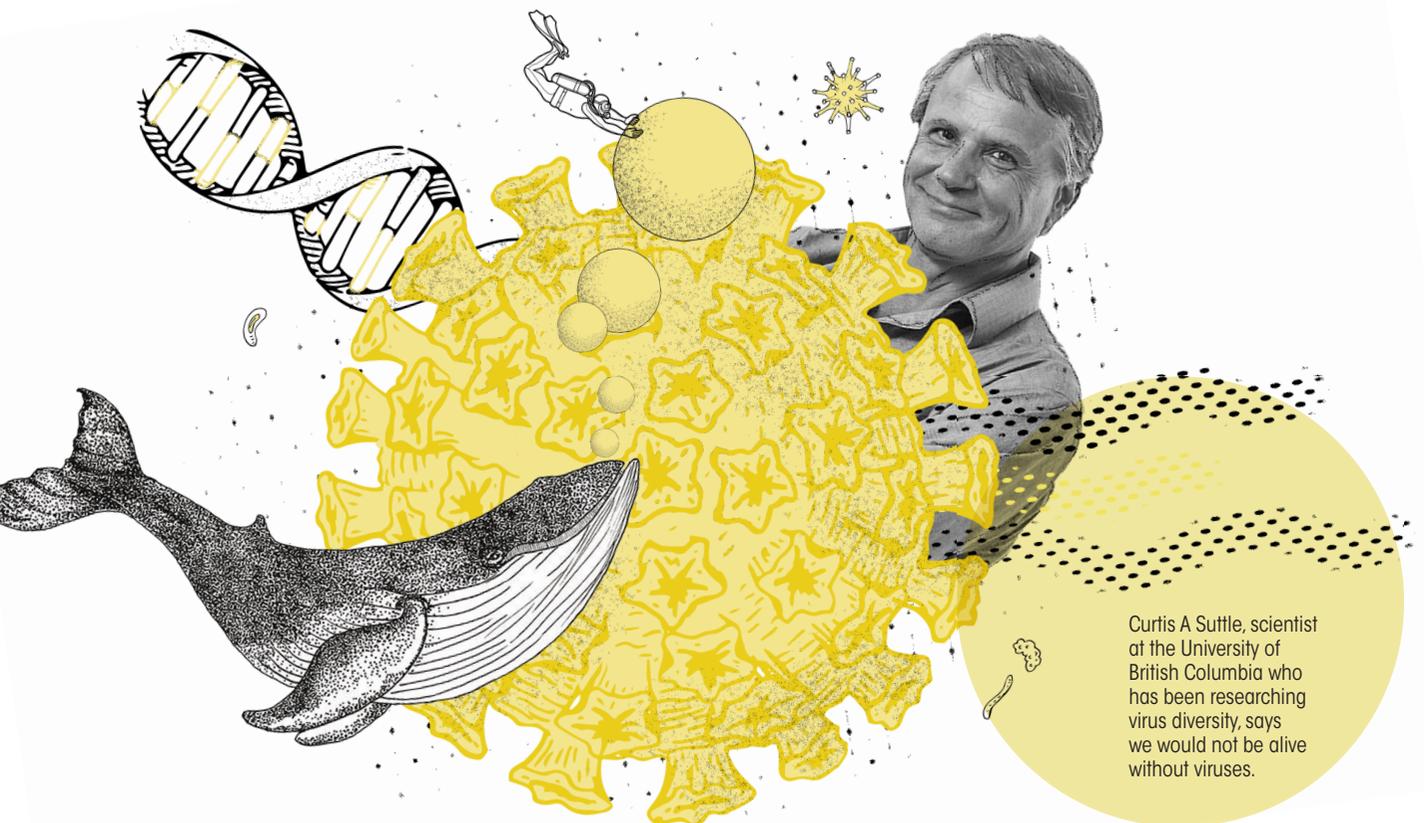
Case in defence

Viruses are being redefined as more than just pathogens

WHAT WE do not understand, we fear. What we fear, we judge as evil. So, are viruses really as notorious as they are being made to be?

Consider this. About 100 million years ago, an ancient virus infected an ancient braconid wasp, inserted its genes among those of its host, and created a partnership for replication. Over the years, the wasp has domesticated the virus to such an extent that it now exists just to serve all braconid species and is also known by the wasp's name. These wasps are parasitic in nature. They lay eggs on live caterpillars so that when the eggs hatch, the grubs can devour the caterpillar—live. To ensure that the grubs do not get killed by the host,

the wasp injects the caterpillars with the viruses. Unlike most other kinds of virus, these bracoviruses cannot make copies of themselves. They are only “created” in the ovaries of the wasps. Their lifecycle ends once they get into the caterpillars. The bracovirus fails to replicate as per its will because its lack the genes required for making the protein coats or capsids. Those coat genes did not vanish. In 2009, Anne Bezier and Jean-Michel Drezen from Francois Rabelais University, France, found that those viral genes are now part of the wasp genome. The bracoviruses are not just the wasps' allies; they are their part. More recently, Gaelen Burke and Michael Strand from the University of



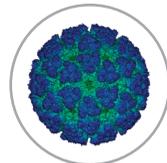
Curtis A Suttle, scientist at the University of British Columbia who has been researching virus diversity, says we would not be alive without viruses.

Georgia, US, have identified two more genes of bracovirus in the wasp genome. The first is a replication set, which the wasps use to “create” the virus in their ovaries. The second is a virulence set, which attacks the caterpillars. The wasps selectively use these viral genes. While creating the viruses, the wasps fill them only with the virulence genes, not the replication ones. That is why the resulting viruses can attack caterpillars, but cannot replicate and spread to new hosts.

Marilyn Roossnick, a researcher from the Pennsylvania State University, US, is an ardent advocate of such beneficial viruses. In an article published in *Molecular Plant Pathology* in May 2015, she writes that viruses can provide a trait to crops to increase their value or growth potential, or decrease the need for the use of chemical fertilisers or pesticides. Some of the beneficial viruses that have been used in plants are those that enhance the beauty of ornamental plants. The tulip breaking virus was the first of a long list of the beautiful viruses, but many other prized ornamentals owe their value, at least in part, to the viruses that infect them. Other such beneficial plant viruses are several acute viruses (brome mosaic virus and cucumber mosaic virus of family Bromoviridae, tobacco rattle virus and tobacco mosaic virus of family Virgaviridae), which confer tolerance to drought and freezing temperatures in several crops. Then there are persistent viruses, such as white clover cryptic virus of family Partitiviridae, that can suppress nodulation in legumes when adequate nitrogen is present. Plant virus strains with mild symptoms have also been used for cross-protection against severe strains.

SHOWING GUT STRENGTH

In humans and other mammal, the guts are rich in such beneficial viruses and bacteria. In fact, the mucous membrane lining the digestive, respiratory and reproductive tracts contain specific viruses, that are called bacteriophage.

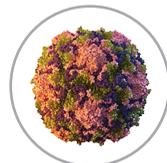


Chikungunya

Endemic areas
Africa, Asia,
Europe

Scare factor

Transmitted to humans by infected mosquitoes, causes fever and severe **joint pain** that is often **debilitating**



Poliovirus

Endemic areas
Africa, Asia,
Europe

Scare factor

Though largely contained by vaccines, it causes **disabling** and **life-threatening** disease that can spread from person to person

Unlike plant and insect viruses, bacterial viruses or bacteriophages infect specific bacteria and destroy their host cells, thereby regulating the population of resident bacteria.

Prior to the discovery of antibiotics by Alexander Fleming in 1928, bacteriophage were being explored as a method for treating bacterial infections. They have actually been used to treat dysentery, sepsis caused by *Staphylococcus aureus*, salmonella infections and skin infections for nearly a century. Then viruses were isolated from local water bodies, dirt, air, sewage and even body fluids from infected patients, purified and then used for treatment. More research into phage therapy was abandoned with the advent of the antibiotic era.

Bacteriophages have attracted renewed interest as we continue to see the rise of drug-resistant infections. Now, scientists are genetically engineering the phages, testing against target bacteria, and the most effective strains are purified into a concentration to be used for treatment.

Then there are viruses that can fight against other viruses. Viral infections at a young age are important to train one’s immune system. Human pegivirus C, also called GBV-C virus or hepatitis G virus, is one that does not seem to cause any disease in humans. Multiple studies have shown that HIV patients when co-infected with GBV-C live longer in comparison to those without it. While research is on to understand the virus’ effect on the immune system, what’s certain is that GBV-C slows disease progression by blocking the host receptors required for viral entry into the cell and by promoting the release of interferons or pathogen alerting proteins of the immune system. Latent or non-symptomatic herpes virus also appears to bolster the immune system. It arms the natural killer cells of the immune system with antigens that helps them identify tumour or cancer cells. Scientists are working on modified versions of such viruses to use them in cancer treatment.

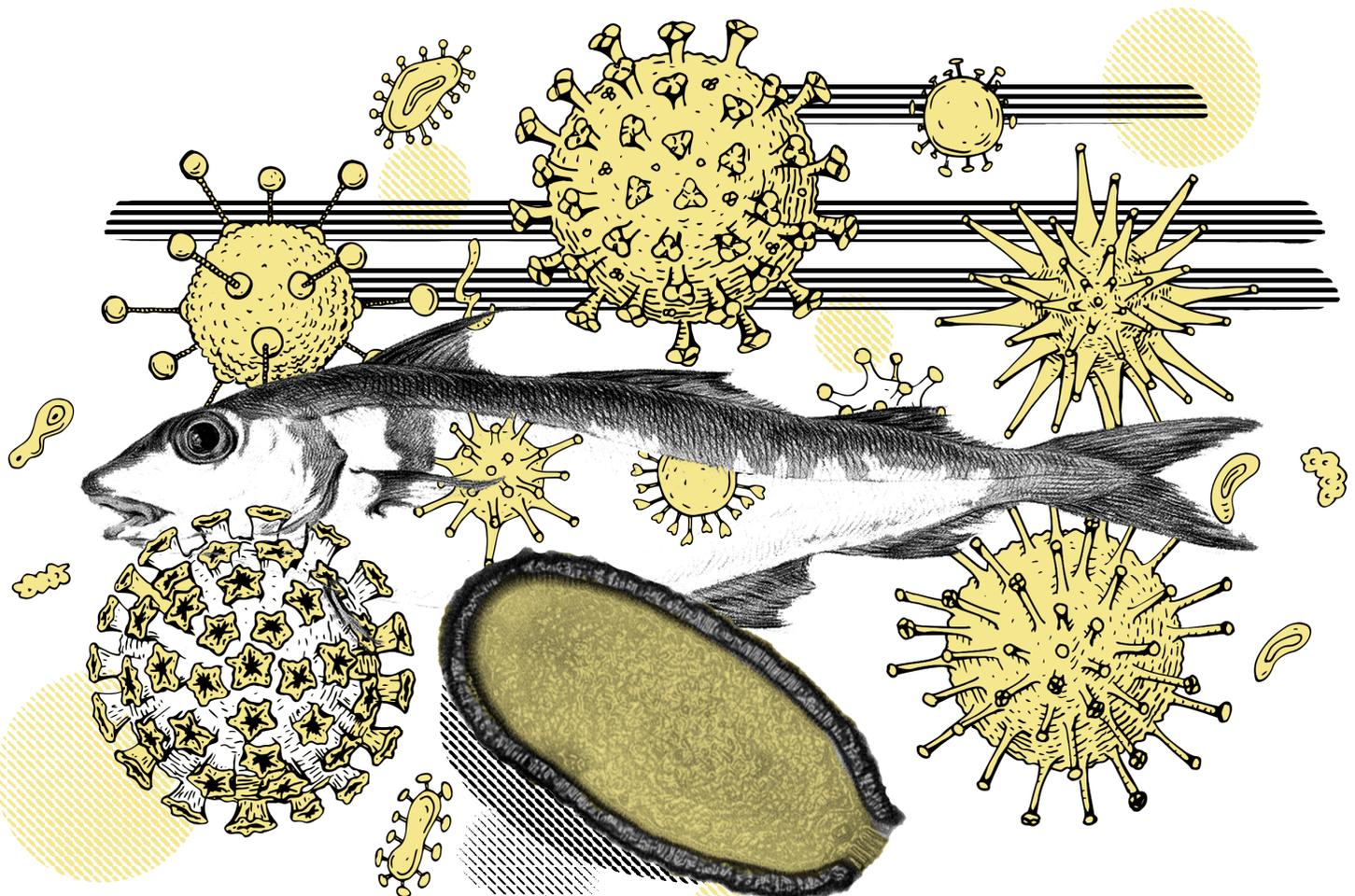
Who's the offender?

Viruses that cheat the cells, cause outbreaks

THIS MAY appear as a philosophical question. But if virus is non-living, what does it gain by being virulent? There is no clear answer to it. But virulence is probably not the agenda of a virus. Because for these tiny invaders, a dead host is a dead end. It disrupts cell function in its desperation to replicate. This makes us sick. In response to infection, the immune system springs into action. White blood cells, antibodies, and other mechanisms go on an overdrive to rid the body of the foreign invader. These cause fever, rash, headache and fatigue. A disease occurs when the immune system loses ground to the virus, and the latter manages to establish itself in the cells for replication.

The replication process typically begins when a virus infects its host by attaching to the host cell and penetrating the cell wall or membrane. The virus' genome is then uncoated from the protein and hijacks the host cell's machinery, forcing it to replicate the viral genome and produce viral proteins to make new capsids. The new viruses then burst out of the host cell during a process called lysis, which kills the host cell. Some viruses take a portion of the host's membrane during the lysis process to form an envelope around the capsid. Following viral replication, the new viruses then go on to infect new hosts (see 'How a flu virus hijacks cell's machinery', p41).

Most of the time body's immune system



is capable enough to get rid of viruses. Problem arises when the virus cheats or attacks the immune system to gain access to a cell and takes control over it. These are the ones capable of causing outbreaks and, sometimes, pandemics.

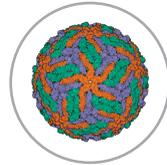
Here we discuss the mechanisms employed by some of the notorious viruses.

REWIRE CELL PROGRAMME

Consider the current threat, SARS-COV-2. It is good at disrupting cellular programming. A typical virus replaces less than one per cent of the genetic material in the cells it infects. But SARS-COV-2 replaces about 60 per cent of the RNA in an infected cell. Among other things, the virus also rewires the alarm system that cells use to warn others about infection.

Usually, as part of what is known as the “innate” immune response—so called because it is genetically hardwired, and not tailored to a specific pathogen—a cell sends out two kinds of signals. One signal, carried by molecules called interferons, which travel to neighbouring cells, telling them to build defences that slow viral spread. Another signal, transmitted through molecules called cytokines, gets a message to the circulatory system’s epithelial lining. The white blood cells summoned by this second signal do not just eat invaders and infected cells; they also gather up their dismembered protein parts. Elsewhere in the immune system, these fragments are used to create virus-specific antibodies, as part of a sophisticated “adaptive” response that can take six or seven days to develop. Mostly, viruses that create outbreaks or debilitating diseases are successful because they shut down both of these signalling programs. But SARS-COV-2 is different as it seems to block only one of those two arms.

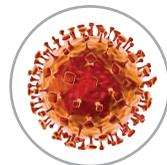
It inhibits the interferon response but does nothing about the cytokines; it evades the local defences but allows the cells it infects to call for reinforcements. White blood cells are powerful weapons and are



Japanese encephalitis

Endemic areas
Africa, Asia, Europe

Scare factor
Although rare, **case fatality rate** among those with encephalitis can be as high as **30 per cent**



Nipah

Endemic areas
Africa, Asia, Europe

Scare factor
Infects a **wide range** of animals and causes **severe disease and death in people**

meant to be used selectively. Once they arrive on an inflammatory tide, they leave behind a trail of destruction. With SARS-COV-2, inflammation distends the lungs and debris fills them like a fog.

These findings are published in May in the journal *Cell*. In the article, the researchers argue that this imbalanced immune response gives rise to an autoimmune disorder-of-sorts—which ranges from blood clots, strange swelling in children and cytokine storms—among those who develop severe cases of COVID-19. Individuals with COVID-19 face the same challenge as nations during the pandemic: if they can’t contain small sites of infection early—so that a targeted response can root them out—they end up mounting interventions so large that the shock inflicts its own damage.

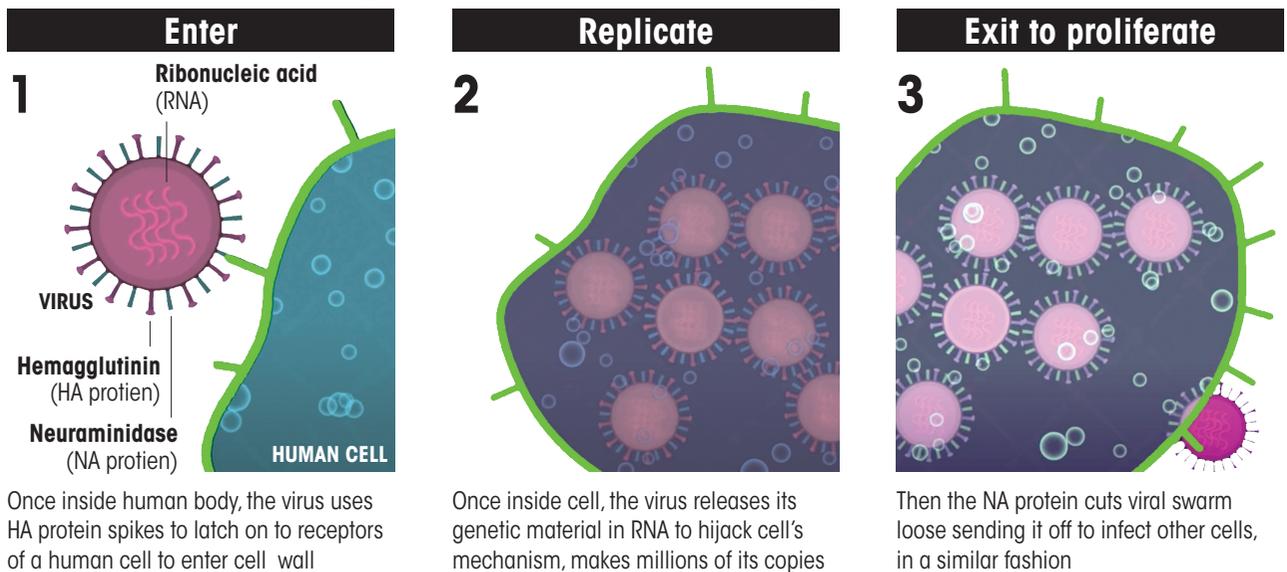
ATTACK AND DODGE

The other such notorious virus is HIV, or the human immunodeficiency virus, that causes acquired immunodeficiency syndrome (AIDS). HIV appears to have jumped to humans early in the 20th century from a type of chimpanzee in West Africa—most likely when humans hunted these animals for meat and came into contact with their infected blood. The virus slowly spread across Africa and later to other parts of the world.

As of 2019 close to 38 million people worldwide were infected with HIV; a total of 32 million have died since the outbreak began. Unlike most other viruses, HIV attacks the immune system, destroying a type of white blood cell (T cells) that the immune system needs to fight disease. The HIV virus then takes over its cell machinery to create more viral particles. These particles then further infect other cells of the immune system, including T cells, and restart the process of hijacking the cell machinery.

What makes HIV jump to other species from their natural host is the fact that the virus is evolved to dodge its natural host’s tetherin—a protein that tethers newly

How a flu virus hijacks cell's machinery



made viruses to stop their release from the cell. Interestingly, of the four strains of HIV—Group M, N O and P—which made the jump from their primate host to humans at various points in time, only M was able to evolve an evasive mechanism to escape tetherin. It is therefore the most successful of all the HIV strains and is responsible for 90 per cent of the infections.

However, what has made ridding the human host of the HIV virus so difficult, despite the use of antiviral drugs, is the ability of the virus to form reservoirs in immune cells that can remain undetected. Studies have found that these reservoirs do not diminish even after 14 years of uninterrupted treatment.

CHANGE WAR STRATEGIES

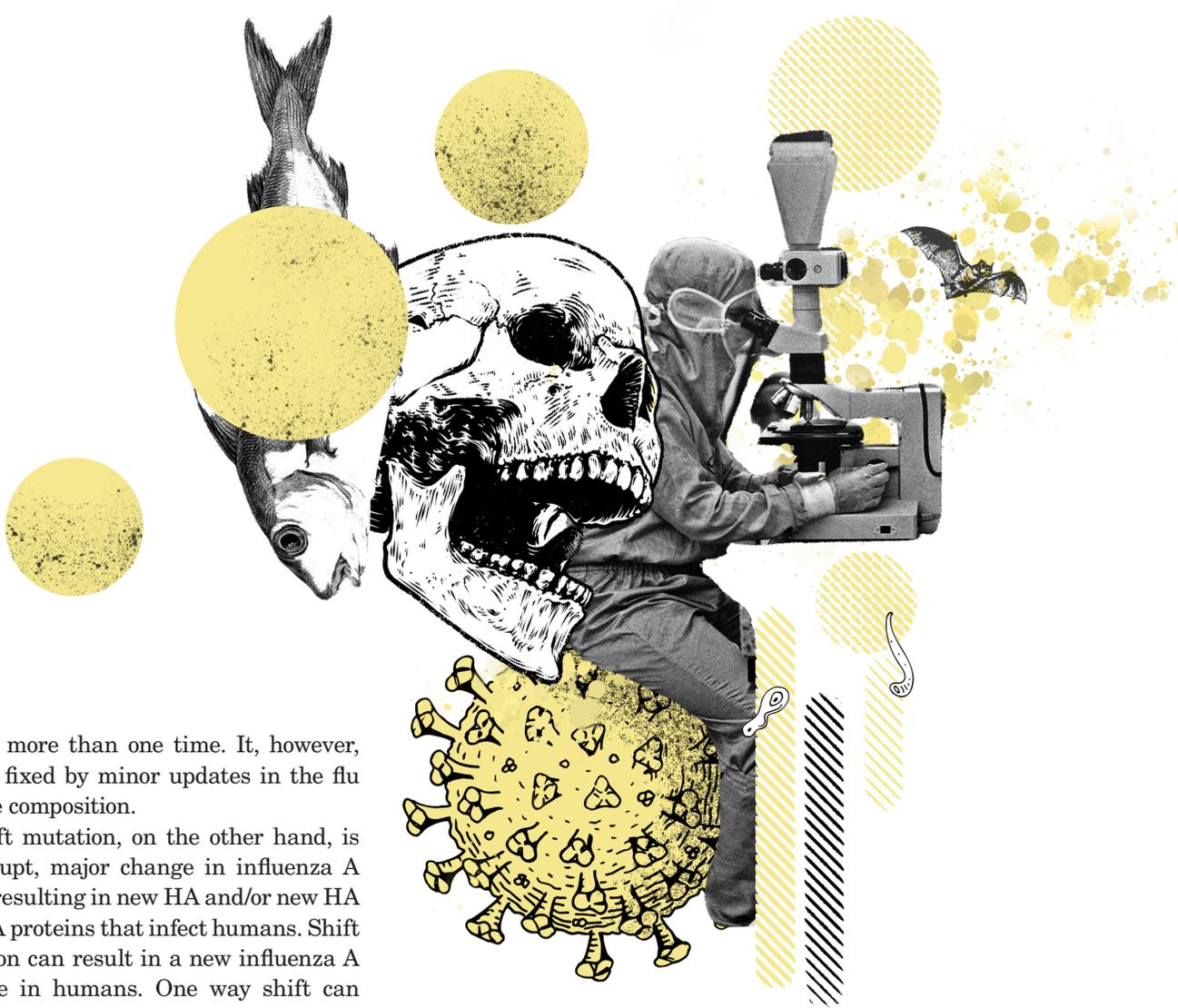
One virus that keeps health experts on their toes is influenza A. It is a highly contagious virus that kills half a million people globally every year. It was also responsible for history's four deadliest pandemics and experts predict that the next one will also be caused by them.

What makes this parasite deadlier than most other viruses is its ability to undergo sudden and complete mutation. This is possible due to its peculiar

structure. Most viruses are made up of either a single RNA or DNA strand which stores its genes. But flu virus has eight RNA strands, which means it infects hosts easily and they replicate quickly in them, explains Shahid Jameel, an eminent virologist and former head of DBT/Wellcome Trust India Alliance, a biomedical research charity.

On its surface, there are two protein types—HA (haemagglutinin) and NA (neuraminidase). There are 18 H proteins (H1 to H18) and 11 N proteins (N1 to N11). When influenza virus mutates, it can result in 198 subtypes of influenza A viruses (11 multiplied by 18). As per the US Centres for Disease Control and Prevention (CDC), 131 subtypes are known. Of these, only two influenza A types—H1N1 and H3N2—are in circulation.

Influenza viruses can mutate in two ways: drift and shift. Drift mutations cause small changes in the genes of influenza virus, resulting in viruses that have similar antigenic properties or are closely related to one another. This means antibodies that get created in a human being to fight one influenza virus will respond to its other close relative. Drift mutations are the reason people can get



the flu more than one time. It, however, can be fixed by minor updates in the flu vaccine composition.

Shift mutation, on the other hand, is an abrupt, major change in influenza A virus, resulting in new HA and/or new HA and NA proteins that infect humans. Shift mutation can result in a new influenza A subtype in humans. One way shift can happen is when an influenza virus from an animal population gains the ability to infect humans. Such animal-origin viruses can contain an HA or HA/NA combination that is so different from the same subtype in humans that most people do not have immunity to the “novel” virus.

“Such a shift occurred in 2009, when an H1N1 virus with genes from North American Swine, Eurasian Swine, humans and birds emerged to infect people and quickly spread, causing a pandemic,” suggests CDC. When shift mutation happens, most people have little or no immunity against the new virus.

All the four pandemics before COVID-19 were precisely because of shift mutations, says T Jacob John, virologist and former professor at the Christian Medical College, Vellore. He adds that the other challenge is that influenza A is a respiratory pathogen. “You can avoid other viruses that cause chikungunya and hepatitis C

which are transmitted by mosquito bite or contaminated water,” he says. But how can you stop breathing?

But what propels these much dreaded mutations? “Sea animals, mainly aquatic birds are natural reservoirs or hosts of flu virus. These viruses don’t harm them. But when they jump to human beings via any intermediary host, it mutates,” says Lalit Kant, infectious diseases expert.

The World Health Organization keeps a watch over flu outbreaks happening globally and records all mutations on a platform called Flunet, set up in 1997. In October 2020, the online platform said 172 influenza positive cases were reported and 108 were influenza A.

Kant adds that climate change is abetting this transition. “Aquatic birds are flying to such areas where they did not use to do so earlier. So the viruses are spreading to those areas which otherwise would not have gotten them,” he says.

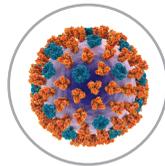
KNOW THEM BETTER

Such frequent outbreaks of viral diseases is a worrying trend. First, because, vaccines do not work against all viruses. Then, antiviral drugs are not easy to make. The reason lies in the fact that unlike bacteria, viruses replicate inside the host cell. So, any drug that targets its replication process will end up targeting the host cell. Killing viruses is easy. Keeping host cells alive while you do it is the hard part. Vaccines, which work by inducing the immune system to produce antibodies against a pathogen, is usually used to prevent a viral infection.

Frequent outbreaks of viral diseases may also lead to antiviral drug resistance. In fact, two commonly used flu drugs—amantadine and rimantadine—have become obsolete and the world is currently left with just Tamiflu antiviral drug, says Jameel. He warns that Tamiflu, which stops the virus from infecting new cells and in turn stops its proliferation, will stop working eventually.

What causes antiviral resistance? There are a couple of explanations from mutations to overuse of antiviral drugs during outbreaks. The world is witnessing misuse of antiviral drugs even now due to the COVID-19, writes Manish Kumar of Indian Institute of Technology-Gandhinagar in a recent paper. The institute has joined a global consortium of 51 premier universities and research institutes to conduct a research study to find out if SARS-COV-2 can survive in human waste. He adds that since these drugs and their metabolites are mostly excreted in the urine, there is the potential for discharge to the environment which eventually reaches water bodies and animals that carry the virus. This could lead to resistance in drugs used for Ebola, influenza and HIV. Vaccines too would become redundant over time and seldom help during a pandemic.

Researchers are now working on a universal vaccine for flu. Instead of the traditional vaccines that rely on the two



Lassa

Endemic areas

Africa, Asia,
Europe

Scare factor

Causes an acute viral haemorrhagic illness with an annual case load of 300,000



Herpes

Endemic areas

Africa, Asia,
Europe

Scare factor

Though mostly asymptomatic, 3.7 billion people have HSV-1 (oral herpes) infection globally

surface proteins that change with mutations, Jameel says, this universal vaccine will attack a third protein, matrix, that remains unchanged. Some researchers are also trying to develop vaccines that will attack the stem of H and N proteins instead of their heads for better efficacy, says Gagandeep Kang, former head of Department of Biotechnology's Translational Health Science and Technology Institute. There are at least 12 universal flu vaccine candidates being worked upon. While some are in pre-clinical stages, a few have reached human trials.

There is an urgent need to speed up the process for understanding viruses and their workings. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), in an extraordinary research paper released in October 2020, warns that pandemics like COVID-19 would hit us more frequently and also kill more than the current one. We are yet to identify some 1.7 million viruses that exist in mammals and birds. Out of these, 50 per cent have the potential or ability to infect humans. IPBES report has analysed the contribution of human-induced environmental damages in the emergence of new diseases. "Land use change is a globally significant driver of pandemics and caused the emergence of more than 30 per cent of new diseases reported since 1960," says the report. "Although COVID-19 has its origins in microbes carried by animals, like all pandemics, its emergence has been entirely driven by human activities," says the report.

"Changes in the way we use land; the expansion and intensification of agriculture and unsustainable trade, production and consumption disrupt nature and increase contact between wildlife, livestock, pathogens and people. This is the path to pandemics," says Peter Daszak, president of EcoHealth Alliance and Chair of IPBES workshop that released the report. **DTE**

 @down2earthindia



Most varieties of coloured cotton being developed in India are of different shades of brown

Colour is back

After three decades of research, India is ready to release its coloured cotton. Is the market ready to embrace it?

MEENAKSHISUSHMA
NEW DELHI

IF YOU thought that natural cotton comes only in white, then this news might surprise you. India is just months away from releasing coloured cotton varieties for commercial farming. Researchers are conducting farm trials for 16301 DB and DDCC 1, which will yield brown cotton lint. “A committee of the Indian Council of Agricultural Research (ICAR) will evaluate their viability at the annual meeting in April 2021, following which the varieties will be released for com-

mercial cultivation,” says A H Prakash, who leads ICAR’s All India Coordinated Research Project on Cotton (AICRP-Cotton), Coimbatore. The agency ensures sustainability of cotton production along with various institutions and agricultural universities.

The variety 16301 DB has been developed by ICAR’s Central Institute for Cotton Research (CICR), Nagpur in Maharashtra, after evaluating five naturally coloured cotton varieties (or genotypes) of

Gossypium hirsutum, the most widely planted cotton species in the world. DDCC 1 has been developed by the University of Agricultural Sciences, Dharwad in Karnataka, by evaluating six coloured genotypes *G arboreum* species, which is native to India and several other subtropical regions (see ‘Stronger versions’). Prakash says farm trials are also going on for over 15 other coloured varieties, which are in different stages of development (see ‘Hit and trial’).

The success is the result of over three decades of efforts by AICRP to revive coloured cotton, whose use dates back to 5,000 years ago in the country. Scientists believe that coloured cotton was used in the Indus Valley civilisation. Its use is also mentioned in ancient scripture *Vriksha Ayurveda*, which deals with agricultural science. The colours indigenous to the region usually range from dark tan and brown to *khaki*, grey and green.

During the British period and early years of independent India, two varieties—Cocanada 1 and Cocanada 2 of *G arboreum*—were grown in rainfed parts of coastal Andhra Pradesh and the brown fibre was exported to Japan as a premium product. Buff brown cotton in Assam and the light grey coloured Kumta of *G herbaceum* species in Karnataka were under cultivation for several decades in the 19th and 20th century. Even the famous Dhaka muslin is traditionally made by mixing the white and coloured lints of *G arboreum*.

In contrast, the omnipresent white cotton variety was introduced in India only in the last 100 years. But they soon rose to prominence with the advent of Industrial Revolution. Modern textile factories

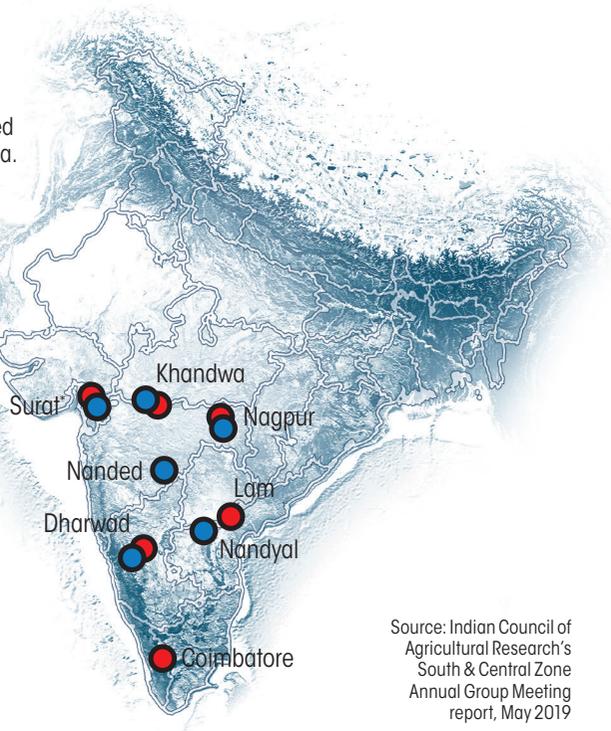
Hit and trial

Trials of naturally coloured cotton are being conducted at several locations in India. Some of these varieties might be commercially released early next year

- *G hirsutum*
- *G arboreum*

G hirsutum is the most widely planted species of cotton in the world. *G arboreum* is native to India and subtropical regions

*In Surat, *G hirsutum* trials are being conducted in both rainfed and irrigated land



Source: Indian Council of Agricultural Research's South & Central Zone Annual Group Meeting report, May 2019

Stronger versions

Coloured cottons are stronger and have better yield than white varieties

WHITE COTTON

466

Mean seed yield (kg/ha)

25-29

Fibre length (mm)

20-23

Fibre strength (g/tex)



DDCC 1

1,265

Mean seed yield (kg/ha)

23.0

Fibre length (mm)

21.7

Fibre strength (g/tex)

16301 DB

1,777

Mean seed yield (kg/ha)

24.1

Fibre length (mm)

22.0

Fibre strength (g/tex)

Source: All India Coordinated Research Project on Cotton, Coimbatore; *How Colourful is the Future of Naturally Coloured Cotton?* by KR Kranthi

needed longer and stronger threads which the coloured varieties could not provide. The advancement of chemical dyeing further made them irrelevant.

Today, at the National Gene Bank of Cotton, which preserves nearly 6,000 varieties of cotton germplasm, one can find over 50 coloured varieties that have been collected indigenously and from Mexico, Egypt, Peru, Israel, the erstwhile USSR and the US. But their cultivation is limited to only a few varieties grown by a handful of tribal communities in the Narmada basin of Central India.

A LONG WAIT

Scientists say the only way to rescue coloured cotton from oblivion is to improve the genome of its varieties so that they are strong and long enough to be used by modern textile machines. But breeding a new genetic variety is a time consuming and tedious process. The first step

“It is resistant to pest, flames and as elastic as wool”

SALLY FOX is a US-based cotton breeder who developed the first species of coloured cotton that could be spun into thread on a machine

When did you start the research on naturally coloured cotton and what was your inspiration?

I was working for an independent cotton breeder in 1982. He had kept the coloured varieties in his greenhouse because they possess great resistance to diseases and pests. When I saw the naturally colourful cotton I wanted to spin it up right away. But the fibre of the brown cotton was hard to spin, so I asked him why we did not breed these cottons to have better fibre. He said that there was no market. I said why don't we make a market after improving the fibre? He was in his 70s and I was in my 20s. We both laughed and I began my work, which continues to this day.



seeds and made selections year after year. Cotton generally self pollinates and so worries of cross-contamination of seed stock is often unwarranted.

Who are your buyers and how big is your farm?

By 1990, I had developed dependable varieties of naturally coloured cottons that could be machine-spun and organically grown. My first customer was a fine spinning mill in Japan. I then began working with designers in the US and Europe and soon began selling to mills all over the world. At its peak, I was farming colour cotton in thousands of hectares and selling it to 38 spinning mills around the world. The market

Was coloured cotton a part of cultivation in the US before you started the research?

Yes, it was originally grown by enslaved Africans before our Civil War. Then the Arcadians (Cajun's) of Louisiana grew it. The seeds given to my boss came from the United States Department of Agriculture seed bank. They had been collected in the 1930s in Louisiana, US.

In fact, coloured cotton has been around for a while. Peru started using coloured cotton 7,500 years ago. People in Mexico and Central America have also been using it for about the same time. I have this idea that the word *khaki* comes from the name of the fabrics made from these cottons in India. They were also traditionally used to make the garments of monks and other religious people throughout Asia.

How did you manage to improve the fibre content and spinning quality? Are there any biosafety concerns with these cotton varieties?

I started by hand spinning the fibre around each seed and planting those that were the easiest to spin and the nicest in colour. I cross-pollinated the flowers from these with white cottons that had lovely lint and planted those

grew too quickly and within five years it peaked and then painfully collapsed due to globalisation that pushed every one of the spinning mills that I sold to out of business. I now grow crops on order. I currently sell to a spinning mill in Japan and another in the US besides producing my own textiles.

Have researchers from other countries approached you to get some samples of the variety and cultivate the same?

No, I am not a research organisation but a small business. Sadly I enjoy no support from any institutions. I fund all my research by selling the cotton, and the products that I make from it.

How big is the coloured cotton market?

I think the sky is the limit to the market because of its qualities in addition to its innate colour. It is pest and disease resistant; it is resistant to flames; it is antimicrobial; it is as elastic a fibre as wool. You can need little or no dyeing and this reduces both energy and water use as well as waste. But is there a market for it? Well, it seems to still be a work in progress.

involves identifying coloured and white varieties with desired traits, explains Devendra Shrivastava, a plant breeder at the B M College of Agriculture, Khandwa, which is part of AICRP. The varieties are then cross-bred, usually in small pots, resulting in a number of new varieties with different traits—some desirable and others not. The process is then repeated using the varieties with desirable traits. It takes years of such crossing and recrossing to produce the variety that has all the desired traits and is stable, meaning it is able to pass on the acquired traits to the next generation.

In the next step, which usually extends for three years, scientists closely check the yield, length, strength and colour quality of the stable varieties. Farm trial is the final stage where the variety is grown in small isolated farmlands in different climatic conditions to assess the real-world performance.

The first such promising coloured cotton was KC 94-2, released by the Jawaharlal Nehru Krishi Vishwa Vidyalaya's Khandwa Campus in 1996. The almond brown-coloured cotton variety failed to pick up due to low yields. In the 2000s, several varieties of coloured cotton were developed during the implementation of the Technology Mission on Cotton by the Union agriculture ministry. But none of the varieties had the strength or length required by the cloth industry. In 2013, CICR developed a hybrid dark brown cotton, MSH 53, after cross-breeding *G hirsutum* and *G barbadense* with two wild species—*G raimondii* and *G thurber*. It was the world's first variety to have been developed by cross-breeding with wild species. The variety is yet to reach the stage of farm trial.

READY FOR INDUSTRY

Modern textile industries ideally prefer a variety with fibre length of 25-29 mm. The two varieties currently being considered for commercial release—16301 DB and DDCC 1—have a mean fibre length of 23-24 mm, which falls in medium category and can be used in the handloom sector. They, however, have a fibre strength of 20-23 g/tex (mass in grams per 1,000 metres), which is well within

of water and toxic chemicals (see 'It is resistant to pest, flames...'). Most importantly, naturally coloured cotton can reduce farmers' dependency on genetically modified Bt cotton, that has proved to be a grim economic experience for farmers and has a high environmental impact for this largest cotton cultivating country.

As of now, coloured cotton does not command a premium price despite being organic. The industry



Compared to white, coloured cotton grows on a fraction pesticides

the textiles industry standard. They also provide a higher yield—1,200 to 1,800 kg per hectare—when compared to white cotton that yields 466 kg per ha.

However, the biggest advantage of these varieties is their potential to reduce the environmental impact and production cost of cotton. Regular white cotton alone uses more than half of the chemical pesticides used in the entire agricultural production in India. By comparison, coloured cotton varieties are genetically wired to ward off pests and require lesser pesticides. Besides, they require little or no dyeing, which uses a lot

too does not appear keen on using it. One of the reasons, other than the length and tenacity of the fibre, is that the market yards do not provide any special facilities for coloured cotton to be stocked or sold separately.

But their demand is increasing with growing environmental consciousness of consumers. In the last few years, the demand of naturally coloured cotton has increased in some European countries, which is estimated to be about 0.5-0.6 million bales per annum. This might bring coloured cotton back in business. **DTE**

 @down2earthindia

Tricky path to open research data

ONE OF the salutary fallouts of the SARS-cov-2 pandemic has been the realisation that openness in research data is vital; and, that sharing scientific knowledge will benefit humanity at large. That's why Open Access (OA) has become a buzzword in recent months. The world—or at least those parts of it where science is a core societal value—has just marked Open Access Week (October 19-25) underscoring the benefits of a knowledge-sharing system that is more equitable and transparent to advance scientific breakthroughs.

Simply explained, OA is a movement that seeks to make academic information contained in science journals and platforms freely available online immediately after publication. That means there are no financial, legal or technical barriers in accessing such intellectual property. Traditionally, publishers of scientific research and data have been an oligopoly that has put research data and articles behind paywalls, allowing access only through high subscription rates that are generally unaffordable. In the OA system, governments and universities or the scientists and the scholars pay to have their research published. Thereafter, it becomes free to all.

October saw a burgeoning of OA initiatives. *Springer*, the publisher of *Nature* announced its first deal to allow researchers to publish in the journal, and in 33 other *Nature*-branded titles, under OA terms. In Doha, the Qatar National Library announced the inaugural Open Initiative Awards for the advancement of open scholarship in the tiny Gulf state. India has no policy on OA, but one of the proposals under consideration is an expert group recommendation for a 'one nation one subscription' formula. Under this, the government will negotiate with leading publishers of scientific and scholarly journals

for a country-wide open access policy for a single subscription. In return, India will provide access to all published data by every individual living in the country. How practical this remains to be seen.

OA took off in 2000 after Nobel Prize winner Harold Varmus, along with Patrick Brown and Michael Eisen, set up the Public Library of Science, now known only by its acronym PLOS, to provide "the full contents of the published record of research and scholarly discourse in medicine and the life sciences in a freely accessible, fully searchable, interlinked form". It is a noble ideal, but it has not panned out the way it was envisaged. A recent study finds the oligopoly of traditional

The open access system to make scientific research more accessible is growing, but it's also creating new oligopolies

publishers is being replicated by new OA players. The irony is that PLOS itself figures high on the list, just behind *Springer* which is using its

strength in traditional publishing to bolster its OA presence.

A fundamental reason is publishing costs. These have merely simply shifted from subscriptions paid mostly by university libraries to fees charged to authors as article-processing charges or APCs. These can be huge (thousands of dollars per paper) and can "perpetuate and even reinforce an already well-documented system of discrimination that excludes important groups from having their research disseminated through formal channels of scientific communication." Even universities are worried because they could end up paying more to help their scientists publish their work than they do now for subscriptions. And scientists with small research budgets cannot afford APCs. What is the way out? It is time to go back to the drawing board and find ways of making science more open. [DTE](#)

 @ljishnu

Palette

WHAT'S INSIDE

The white secrets on dark matter **P50**

The next COVID virus on the anvil **P54**

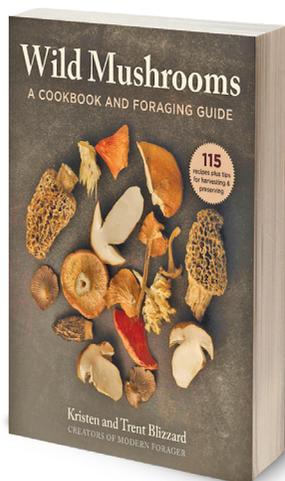
Whose savings saved the Indian economy? **P58**

RECOMMENDATIONS

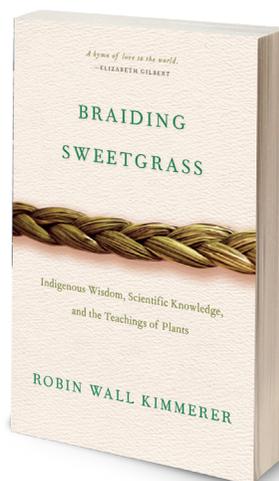


National Geographic will air three documentaries on viruses and pandemics from November 23. The first one, *Os Cacadores de Virus*, captures the dual nature of viruses—a threat to humanity and how they have played a key role in evolution, creating and shaping human species. The next one, *Contagion: From Ebola to COVID-19* is a retrospective on how viruses have evolved and spread across the world. The third documentary *Breakthrough: The fight against the virus* follows scientists, virus hunters, doctors and detectives who are trying to find the origin of the virus and how people across the world have used various methods to fight the pandemic.

BOOKS



Wild Mushrooms reveals how to locate, clean, collect and preserve mushrooms. This new book synthesises the learning experiences of 20 skilled mushroom foragers and reveals the various preservation techniques, including safety, edibility and flavour of various species. The book categorises various mushroom species and offers 115 recipes, including smoked marinated wild mushrooms, black trumpet and candy cap, among other ones.



Robin Wall Kimmerer says awakening of ecological consciousness requires the acknowledgment and celebration of our reciprocal relationship with the rest of the living world. As a botanist, Kimmerer embraces the notion that plants and animals are our oldest teachers. In *Braiding Sweetgrass*, Kimmerer enjoins the two principles of knowledge to embark on an exciting journey on how other living beings—asters and goldenrod, strawberries and squash, salamanders, algae, and sweetgrass—offer us gifts and lessons, even if we've forgotten how to hear their voices.



New light on dark matter

SCIENTIFIC RESEARCH IS UNEARTHING NEW UNDERSTANDING ON AN OLD MYSTERY

AKSHIT SANGOMLA

DECIPHERING THE true nature of the mysterious dark matter—that constitutes 27 per cent of the Universe—has eluded scientists since it was discovered by Fritz Zwicky in 1933. Dark matter attracts everything through gravity; it competes with the equally mysterious dark energy that pulls apart everything in the Universe. These two competing forces shape the Universe at the largest scale. Dark energy, which constitutes 68 per cent of the Universe, is

also the most plausible cause for the observed accelerated expansion of the Universe. This means that all the stars, planets and other celestial bodies—visible to us—make up only 5 per cent of the Universe. The rest is yet unknown. But new scientific evidence is now interpreting this mystery.

To explain current observations of the Universe, scientists say dark matter exists, but it does not emit, absorb or reflect light. This makes it

PHOTOGRAPHS: NASA.GOV



Dark matter exists, but it does not emit, absorb or reflect light. This makes it difficult to detect

difficult to detect. The only way that its existence can be inferred is through the gravitational pull it exerts on other matter in the form of stars, planets and other celestial objects.

That's why astronomers look at galaxies and clusters of galaxies—the grandest structures of the Universe—to understand dark matter: what it is and why it exists in the first place.

Scientists believe dark matter is lightly smeared across the Universe which again makes it difficult to look for. A galaxy cluster can have around 1,000 individual galaxies, each with its own smattering of dark

matter, and this increases the dark matter concentration in these clusters.

This, in turn, makes it easier for astronomers to search. Another place scientists have been looking is deep under the Earth's surface where they have been detecting possible particles that could make up dark matter in Xenon tanks—the largest propellant tank made by humans—and even in rocks.

Two candidates for such particles are the weakly interacting massive particles (WIMPs) and axions—a hypothetical elementary particle. In case of Xenon tanks, scientists looked for collisions between WIMPs and the central nucleus of the chemically-inert Xenon atoms. They observed collisions in the form of tiny light flashes which haven't been detected as yet.

SHADES OF NEW EVIDENCE

But in June this year, scientists working on the XENON1T detector—located under Gran Sasso mountain in Italy—might have found axions, instead of WIMPs. They found an excess of collisions of particles with electrons in the Xenon tank much more than what should be expected. But they want to be sure about their results. They are now in the process of designing a successor experiment to XENON1T.

GAPS AND ANOMALIES ARE MISSING IN OUR UNDERSTANDING OF DARK MATTER AND THEY POINT TO A NEW MODEL, WHICH WILL HAVE MORE EXPLANATORY SCIENTIFIC POWER

They say electronic collisions might be coming from Tritium contamination or a new unknown behaviour of neutrinos.

Neither the macrocosm approach of galaxy clusters nor the microcosm approaches of detecting particles have yet yielded definitive results despite decades of research. That's why scientists are also revisiting an old hypothesis of dark matter which says that it is basically a hidden set of primordial black holes that were formed during the Big Bang.

The hypothesis got some momentum in September 2015 when the Laser Interferometer Gravitational-Wave Observatory (LIGO) in the US sensed gravitational waves for the first-time ever. The waves came from the collision of an odd pair of black holes that weighed around 30 times the mass of the Sun, which had never been observed before. This led scientists to predict there were a lot more black holes than previously expected; and, these would occur in binary pairs spiralling ever so close, and finally merging into each other.

LIGO had detected many of these mergers, but not enough to corroborate the primordial black holes as an issue of dark matter. A recent paper shows how a huge population of the Big Bang produced black holes that may have resulted in collisions; they now sit perfectly with what LIGO has observed.

But all these hypothesising and research may go to waste because of recent observations by astronomers. The latest was the discovery of excessive presence of dark matter in the spiral galaxy NGC 5585 on September 21, 2020, by the Hubble Space Telescope operated by the European Space

Agency (ESA) and the National Aeronautics and Space Administration (NASA). All the stars, planets and other visible matter in the galaxy—which rests on the tail of the Great Bear in the Ursa Major constellation at a distance of 25.5 million light years from Earth—could not make up the total mass of the galaxy. So the proportion of dark matter in this mass was far higher than what it should be according to their models.

The startling findings have made the mystery even darker. The second set of observations came from a cluster of galaxies—MACS J1206.2-0847, MACS J0416.1-2403, and Abell S1063—made by the Hubble Space Telescope of NASA and ESA and the Very Large Telescope (VLT) of the European Southern Observatory (ESO). The study was published in *Science* on September 11, 2020.

Scientists also observed that “in addition to the dramatic arcs and elongated features of distant galaxies produced by each cluster’s gravitational lensing, the Hubble images also revealed an unexpected number of smaller-scale arcs and distorted images nested near each cluster’s core, where the most massive galaxies reside”, says ESA. “The researchers believe the nested lenses are produced by the gravity of dense concentrations of matter inside the individual cluster galaxies.”

Further the researchers compared the masses of these galaxy clusters with data from simulations of galaxy clusters of around the same masses and distances. They found that models which are based on current understanding of dark

matter are way off the mark from what was directly observed. “We have done a lot of testing of the data in this study, and we are sure that this mismatch indicates that some physical ingredient is missing either from the simulations or from our understanding of the nature of dark matter,” says Massimo Meneghetti, the study’s lead author and scientist at the ANAF-Observatory of Astrophysics and Space Science of Bologna in Italy.

“There’s a feature of the real Universe that we are simply not capturing in our current theoretical models,” says Priyamvada Natarajan of Yale University in Connecticut, USA.

SCIENTISTS ARE REVISITING AN OLD HYPOTHESIS OF DARK MATTER THAT SAYS THAT IT IS A HIDDEN SET OF PRIMORDIAL BLACK HOLES FORMED DURING THE BIG BANG

Natarajan is one of the senior theorists on the team. “This could signal a gap in our current understanding of the nature of dark matter and its properties, as these exquisite data have permitted us to probe the detailed distribution of dark matter on the smallest scales”, she added.

“To me personally, detecting a gnawing gap—a factor of 10 discrepancy in this case — between an observation and theoretical prediction is very exciting,” says Natarajan. She pointed out the required quality of data and the sophistication of the theoretical models has only now allowed proper testing of what we knew about dark matter till now. “A key goal of my research has

been testing theoretical models with the improving quality of data to find these gaps. It’s these kinds of gaps and anomalies that have often revealed that either we were missing something in the current theory, or it points the way to a brand-new model, which will have more explanatory power”, she added.

“The discrepancy in the amount of dark matter on galaxy scales as revealed by gravitational lensing studies of galaxy clusters could either indicate something new about the nature of the dark matter or imply that we are missing some ordinary process in our numerical simulations of the inner parts of galaxies—where luminous matter concentrates,” says Abraham Loeb, Frank B Baird Jr Professor of Science at Harvard University. He points out that there were indications for discrepancies before this latest study.

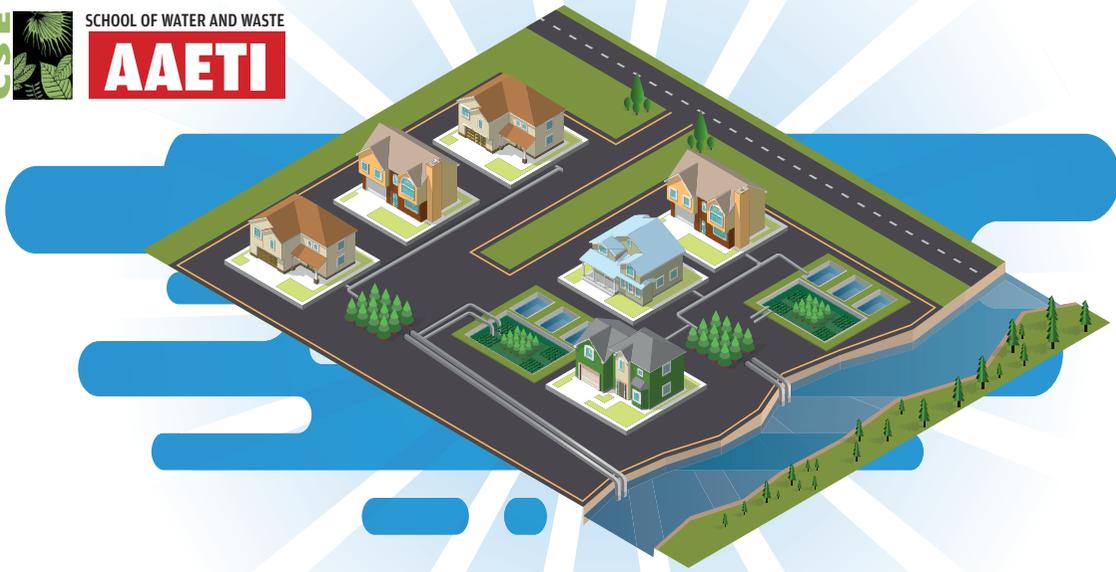
Loeb explains: “Whereas the central parts of galaxies are expected to have a divergent dark matter density (so-called, density cusp), observations indicate that in many galaxies the central dark matter density does not diverge but reaches a constant value, showing a constant density core. It was suggested that the deficiency in dark matter may be the result of scatterings among dark matter particles or a gravitational kick from ordinary matter. The new results from gravitational lensing may also result from similar processes. We need more data to uncover the true reason for these intriguing anomalies.” [DTI](#)

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BASICS OF DECENTRALIZED WASTEWATER TREATMENT AND LOCAL REUSE

Course Dates: 02 December - 30 December, 2020

Total Study Hours: 24 hours Commitment: 6 hours a week Language: English

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- Understanding about the enabling frameworks and regulations applicable to decentralized wastewater treatment including reuse.

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- Practitioners from consultancies, community-based organizations, social-welfare organizations, non-government organizations
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- Representatives of Resident Welfare Association

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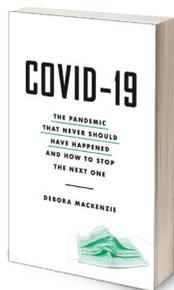
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THE NEXT PANDEMIC
IS NOT FAR AWAY
BANJOT KAUR



COVID-19: The Pandemic that Never Should Have Happened, and How to Stop the Next One

By **Debora MacKenzie**

Publisher: Hachette India

Pages: 304; Price: ₹ 1,801

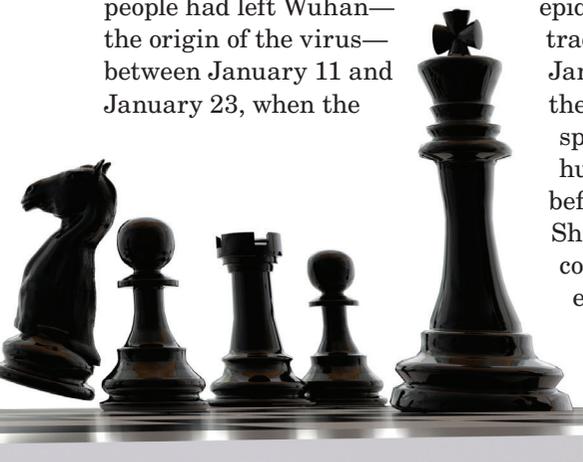
WHILE ENGAGING in discussions on COVID-19—vaccines, therapeutics, second or third waves, re-infection or re-opening the economy—we tend to overlook critical aspects, including where we went wrong, and what can be learnt from our mistakes to prepare for future pandemics. Debora Mackenzie, a journalist working in the area of infectious diseases with *New Scientist* for 36 years, chronicles the world's response to COVID-19. And as experts worldwide have been warning, she too forecasts an impending flu

pandemic in her new book, *COVID-19: The Pandemic that Never Should Have Happened, and How to Stop the Next One*.

Mackenzie has to cut short her holiday when she got her first alert on December 31, 2019 on ProMed—an online volunteer forum to monitoring reports of new infectious outbreaks. It was an alert hard to ignore. She then describes her travails in sourcing information from China, a country notorious for concealing information. Even during the outbreak of the Severe Acute Respiratory Syndrome (SARS),

China took two months to disclose it to the world by which time the infection had spread to other countries.

This time, when Chinese doctors spoke about an “unknown pneumonia” in November, they were censored. It was only on December 31, 2019, the country informed the World Health Organization (WHO), and even then, Chinese authorities ruled out person-to-person spread of infection. That was a costly mistake. She quotes an analysis by the University of Oxford, UK, that as many as 4.3 million people had left Wuhan—the origin of the virus—between January 11 and January 23, when the



city imposed a travel ban. She says if China had imposed the ban a week earlier, it would have prevented 67 per cent of those who got infected by the COVID-19 virus. It was only in late January that human-to-human transmission was confirmed.

If confused messaging was China’s strategy, WHO failed on a number of counts—delayed declaration of a global health emergency, the accusation of toeing the line of the Chinese establishment to an extent of even praising it over-the-board, criticising countries for travel

bans and delayed advisory of the use of masks and indoor transmission. She goes on to make a strong argument that since WHO has faltered—lack of powers among other things—reforming it is our best choice rather than imagining a world without it.

While China’s misses may have been documented, she documents the failures of other countries such as Italy, US and the UK. She quotes Italian official records that said the first case in Italy was reported in February. Yet, she says Italian epidemiologists say the first traceable case was detected on January 1, further supporting the theory that virus was spreading from human to human a couple of months before WHO even got a whiff of it. She goes on to analyse why some countries became models to emulate—Hong Kong, South Korea, Singapore and Taiwan.

A crucial part of the book is on bats; they have become villains, then the search was for the intermediary host—pangolin or a civet. While the debate remains unsettled, Mackenzie collates a huge research even before 2020, which clearly said years before 2020, that coronaviruses—worth causing a pandemic—were definitely being found in bats, something that EcoAlliance, world’s pioneering organisation researching on zoonotic viruses, told *Down To Earth* in February 2020. But if one thought killing bats was the answer, one could end up as being grossly unreasonable. These viruses are naturally present in bats. They cause

no harm to them, but only when they jump species does the crisis begin.

WARNING SIGNALS

Mackenzie says the outbreaks of SARS and the Middle East Respiratory Syndrome (MERS)—both coronaviruses—should have forewarned us of a corona pandemic. But countries always hid their skeletons. China (SARS) and Saudi Arabia (MERS) tried more than best to hide and conceal information. She chronicles important lessons that would have helped us to remain vigilant against coronaviruses, but adds that these were conveniently forgotten. “If SARS was not enough (which was thought to be stamped out), MERS definitely demonstrated that we should have been working more urgently for corona outbreaks. How many warnings did we heed,” she wonders.

But all said and done, all warnings of future pandemics from all the quarters before 2020 were that of a flu virus; and not a coronavirus, though both are respiratory pathogens. Mackenzie warns while this pandemic may lead us to focus on the latter, if we take our eyes off the flu virus—that caused all the other four pandemics in human history—we may be in for trouble.

While efforts to develop a COVID-19 vaccine are on, she reminds us that flu is one virus that has gone on to mutate, thus badly impacting vaccine research. Therefore, research initiatives to find a universal flu vaccine—which can fight all current and upcoming strains need to redouble with adequate funding. [DTE](#) [@banjotkaur](#)



Tree tomatoes can be stored for long periods even at room temperature

An alien gone native

MANY INGREDIENTS quintessential to Indian cuisines have come from the Americas or Europe. Some are well-known—potato, peanut, chickpea and chilli—but there are some that remain relatively obscure. One such ingredient is the tree tomato (tamarillo) or *Solanum betaceum* which has its origin in South America.

The tree tomato is so popular in

TREE TOMATOES FROM NAGALAND ARE A WORTHY SUBSTITUTE FOR THE REGULAR ONES
VIBHA VARSHNEY

Nagaland that the state government got a certificate for Geographical Indication (GI) for it in 2015. This certificate is provided to products that have a specific geographical origin and possess qualities innate to that origin. The tree tomato in Nagaland meets these requirements because it has a long history of cultivation and several specific organoleptic characteristics related to taste and

colour that evolved over time. Since the Naga tree tomato is usually grown in kitchen gardens and farmers raise the seedlings from the mature old plants, the purity of the crop in the state has been maintained.

RED LANDSCAPE

The tamarillo tree is found abundantly in kitchen gardens in all districts of the Naga hills, including Kohima, Wokha, Zunheboto, Kiphire, Tuensang, Mon and Phek. It is a small, evergreen tree with heart-shaped leaves and grows to about 3 metres. The fruits appear when the tree is around three years old and are distinctly egg-shaped. They hang in clusters.

The skin of the fruit varies in colour—from yellow to purple—and is leathery and slightly bitter. The flesh of the fruit is more tart and tangy than the normal tomato. The seeds are flat, circular, larger and harder than those of the regular tomato. The pulp surrounding the seeds is soft, juicy and sweet. It has been observed that the yellow-skinned tomatoes are usually sweeter.

The tree tomato is locally known as *sei bangueno* or *khwüdi* and the North Eastern Regional Agricultural Marketing Corporation Limited has been actively promoting the tree among farmers and ensuring traceability and quality. Other than the tree tomato, Nagaland also has the GI tag for Naga King Chilli (*raja mirchi*) and both the tomato and the chilli are used to prepare a tangy chutney (see recipe).

The tree tomato has many advantages. It fruits through the year and the tomatoes can be stored for long even at room temperature. In times of scarcity of regular tomato, people easily

RECIPE

NAGA TREE TOMATO CHUTNEY

INGREDIENTS

Tree tomato: 4
Raja mirchi: 2
Onion: 1
Green coriander: 1 small bunch
Salt: to taste
Mustard oil: 1 tbsp

METHOD

Roast the tomatoes and remove the skin. Lightly roast the chillies too. Peel and cut the onion. Put all of these in a stone mortar and pestle, add salt and grind to a paste. Add mustard oil and mix well. The chutney is ready to be relished with rice and dal.

shift to this perennial crop. This usually happens in winters when the common tomato becomes very expensive as it has to be imported from other states.

JUICY BENEFITS

The tree tomato is high in pectin fibre which is a natural preservative and can be used to make jellies, jams and chutney. The pectin level is as high as 5 per cent, which is higher than apples (1.0-1.5 per cent), apricots (1.0 per cent), cherries (0.4 per cent), oranges (0.5-3.5 per cent) and carrots (1.4 per cent). It is also rich in antioxidants, vitamins A and C, and an excellent source of calcium, iron, potassium, phosphorus and magnesium.

In comparison to regular tomatoes, tree tomato is richer in carbohydrates, protein, minerals and fibre but contains lesser fat. The tree tomato is attributed with medicinal properties, too. It helps control high blood pressure and brings down cholesterol levels. Some people believe it helps lose weight and is often recommended for consumption after a workout.

Tomato is a staple in cuisines across India and having a no-fuss, cheap alternative is an attractive option. Researchers are already exploring this as a food option for a climate-risked world. It grows best in well-drained soil and cannot tolerate prolonged drought or waterlogged conditions. For instance, researchers from Ecuador, Spain and India studied tree tomatoes grown under two different environmental conditions—traditional cultivation in the open field and under greenhouse conditions. They found that though traditional practices in the open field are less productive, treatment with organic fertilisers increases productivity. The team reported the findings in *PLoS One* in December 2017. This is good news for Nagaland where organic farming is widely prevalent.

As tamarillo is not found in its wild state, its centre of origin is not known. It is considered to be native to the Andes of Peru and Chile, Ecuador and Bolivia. Tamarillos are grown commercially in South and Central America, Australia, Africa and Asia. In New Zealand, tamarillos were promoted during World War II when import of fruits such as bananas and oranges was not possible. This was to ensure that people got adequate vitamins. Before the kiwifruit boom of the 1960s, more hectareage was devoted to tamarillos than to the kiwifruit. In the US, it is cultivated in California after US Department of Agriculture imported seeds from Argentina in 1913, but now it is grown mainly as an ornamental. If demand for the tamarillo increases, it would be good news for Nagaland which already has a GI tag for the fruit and is promoting cultivation. **DTE**

 @vibhavarshney

The value of rural spending

RURAL INDIA has emerged as the saviour of the shattered Indian economy. From Ratan Tata to the Governor of the Reserve Bank of India, everybody is betting on the growth in consumption demand in rural areas to boost the pandemic-stricken economy. There is lot of talk on “green shoots”. These green shoots—whether they are increase in the sale of two-wheelers or rising sale of paints—are mostly related or driven by consumption in rural areas. So, the hope that ultimately Rural India—often perceived as a drag on the overall economy—will see the country through to an economic growth of “zero per cent”. Indian economy is under contraction and reaching a “zero per cent” growth rate indicates significant growth. This will be a rather cheering piece of news.

This paints a rosy picture of the rural economy that includes primarily agriculture and informal jobs. Close to 97 per cent of rural employment is in these two segments. The initial growth in rural demand indicates an increase in income. This is being interpreted as the first signs of the economy on the path of recovery.

While it is true that there is a surge in rural demand, what we need to ask is: will it be a sustained growth? Also, will there be enough growth to rescue the country’s economy? Let’s first understand why this rural surge is happening. It is primarily driven by huge government spending on rural development schemes and welfare measures taken up as relief operations after that great exodus back to villages. These include the unbelievable spike in spending on the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and the foodgrains distribution. It also included the cash support given to millions of households.

By the first half of this fiscal year, the rural development ministry spent around ₹1.25 lakh crore. This was more than the annual budget of the ministry. The agriculture ministry had

already spent more than half of its annual budget. In September, the government made a supplementary demand for additional expenditure of ₹2.35 lakh crore beyond the budgeted amount.

This public expenditure has ensured at least some income for rural households that were rendered income-less after the lockdowns. Also, free and subsidised foodgrains have helped in saving expenditure. For most of the households with informal workers out of villages involves extra expenditure in terms of maintaining an additional establishment. With most of them in villages, though jobless, this expenditure is no more budgeted for. Overall, even in a situation of an economic collapse, people could still earn a bit from wages through MGNREGA and by saving on food expenditure.

If the government cuts expenditure in rural and agro sectors, rural spending may just come down

But can we perceive their spending of savings as a revival of rural demand? Agriculture hectareage has definitely gone up

in both kharif and rabi seasons. This has meant rudimentary spending on inputs. These were expected.

The hope that this demand would be everlasting is not tenable. Though the government has spent a huge amount in rural and agriculture sectors, its overall expenditure, as per budget, remains almost the same. Whether the government will be able to continue its spending as it had in April-September is a question that will decide rural demand. But it will be difficult for the government to maintain this amount of expenditure. By the end of November, the government will start finalising the next Union budget. And in an economy in contraction, it has to decide on which other priority areas to spend or invest. If the government cuts expenditure in rural and agriculture sectors, there is little doubt that rural spending might just come down. [DTI](#)

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